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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

Second Annual Meeting, American Gas Institute.

AMERICAN GAS INSTITUTE,
OFFICE OF THE SECRETARY,
NEW ALBANY, IND., Sept. 11, 1907.

To the Members, American Gas Institute: The second annual meeting of the American Gas Institute will be held at Washington, D. C., October 16, 17 and 18, and will be called to order by the President, Walton Clark, of Philadelphia. The New Willard Hotel has been chosen as headquarters, and the sessions will be held in the auditorium thereof. The Institute will be formally welcomed to Washington by the Honorable H. B. F. MacFarland, President of the Board of Commissioners, District of Columbia.

The following schedule of rates offered by various hotels in Washington are submitted:

		Without Bath—One Person.		Without Bath—Two Persons.		With Bath—One Person.		With Bath—Two Persons.	
		Single Room.	Double Room.	Double Room.	Extra Large Room.	Single Room.	Double Room.	Double Room.	Extra Large Room.
New Willard.	E	$2.50 up.	$3.00 up	....	$4.00 up.	$3.50 up.	$4.00 up.	$5.00 up.	$5.50 up.
Raleigh.....	E	2.00	3.00	4.00	4.00	3.00 3.50	4.00 .	4.00 6.00	6.00 up.
Occidental.....	E	Suites, 2 bedrooms, Parlor and bath, $4 and $5							
Shoreham	E	2.00	3.00	4.00	5.00	3.00	4.00	5.00	7.00
	A	4.00	5.00	8.00	9.00	5.00	6.00	9.00	11.00
Arlington	E	2.00	....	4.00	4.00	3.00	....	5.00	5.00
	A	4.00	....	4.00	8.00	5.00	....	9.00	9.00
Normandie ...	E	1.50	2.00	2.00	2.50	2.00	3.00	4.00	4.00
	A	3.00	3.50	5.00	6.00	3.50	5.00	8.00	8.00
Riggs House..	A	3.00	3.50	6.00	7.00	4.00	5.00	8.00	10.00
Grafton	A	3.00	3.50	6.00	....	5.00	6.00	8.00	....
		....	5.00	8.00	....	....	....	9.00	....
Cochran.....	A	....	....	....	....	....	4.00	7.00	....
Metropolitan..	E	1.00	2.00	2.00	3.00	2.00	2.50	4.00	6.00
		...	...	..	..	...	3.00	....	up
	A	2.50	3.00	5.00	6.00	3.50	4.00	7.00	8.00 up
Ebbitt.....	A	3.00	....	6.00	....	5.00	6.00	10.00	....
		4.00	....	up	....	....	....	....	....
St. James.....	E	1.00	2.50	3.00	....	2.50	3.00	4.00	....
		2.00	4.00	4.00	....	3.00	4.00	6.00	....
National.....	E	1.00	2.00	2.50	3.00	2.00	....	4.00	....
		.	..	....	..	2.50	....	....	....
		2.50	3.00	5.00	6.00	3.50	....	7.00	....
		....	....	....	....	4.00	....	....	....
Howard House	E	2.00	....	2.00	6.00	....	....	....	....
		2.00	....	2.50	....	....	....	....	....

E—European Plan. A—American Plan.

The named papers have been secured by the President for presentation to the Institute, together with the reports of the following committees:

"Depreciation;" by Mr. A. C. Humphreys.

Communication from New England Association; by Its Committee on Uniform Accounting and Depreciation.

Report of Committee on Methods of Taking Candle Power; by Mr. Wm. H. Gartley, Chairman, Philadelphia, Pa.

"The Obligations Imposed by the Possession of a Franchise;" by Mr. Chas. H. Dickey.

Report of Public Policy Committee; Mr. E. G. Cowdery, Chairman.

Report of Committee on Making of Rates and Additional System of Costs; Mr. W. H. Gardiner, Chairman.

Report of Committee on Economic Balance between Calorific Value and Candle Power; Mr. Thos. D. Miller, Chairman.

Report of Committee on Board of Revision; Mr. J. D. Shattuck, Chairman.

"Instructions for Operating Recuperative Benches;" by Mr. W. A. Baehr.

"Experiments in Carbonization;" by Mr. W. H. Fulweiler,

Lecture on "Electrolysis;" by Prof. A. F. Ganz,

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Report of Committee on Electrolysis; Mr. A. G. Glasgow, Chairman.

Report of Committee on Pipe Standards; Mr. Walton Forstall, Chairman.

Experience with Dipping Meters; reports from Baltimore, by Mr. George Beadenkopf. Also reports from Philadelphia and Savannah.

Report on "A" Meter Results from Philadelphia and Kansas City.

Report of Committee on Uniformity of Meters; Mr. Charles H. Dickey, Chairman.

"Air Blast Gas Appliances," by Messrs. W. K. Eavenson, Philip Cross and W. H. Allen.

Wrinkle Department, by the Editors.

The Passenger Associations will not consider rates on the certificate plan until after their next meeting, which convenes September 10th. Many State Legislatures having enacted the 2-cent rate, the Commissioner of the Trunk Line Association writes as follows:

143 LIBERTY ST., N. Y., July 25th, 1907.

MR. JAS. W. DUNBAR, Sec. American Gas Institute, New Albany, Ind.:

Dear Sir—Referring to your letter of the 15th, beg to advise that, on account of the unsettled rate conditions, the Trunk Lines feel they cannot consider the question of reduced fares for meetings or conventions to be held after the month of September, until their next meeting, which will convene on September 10th, after which we will promptly communicate to you decision reached respecting your application.

Yours truly,
(Signed) L. P. BARNES, Commissioner.

The Secretary will be pleased to mail applications to those who may wish to become members of the Institute. Further detailed information in reference to the convention will be forthcoming.

Yours truly, JAMES W. DUNBAR, Secretary.

BRIEFLY TOLD.

M. NISBET-LATTA'S "HANDBOOK OF AMERICAN GAS ENGINEERING PRACTICE."—We are indebted to the courtesy of the D. Van Nostrand Company, of this city, for a copy of the work by Mr. M. Nisbet-Latta, entitled "Handbook of American Gas Engineering Practice," which is virtually just from the printers. We hail it with acclaim, for it is in reality the first American book published that deals with American gas practice, especially with reference to water gas manufacture and distribution. And that a demand for such a work exists is certain from the number of inquiries that come to the JOURNAL office in the course of the year for a book treating on the making of water gas. It is, as the author says in his preface to the volume, a fact that "American gas engineers have for a long time deplored the lack of a work treating on the technology of modern gas supplies from a practical standpoint, and framed in such a manner as to constitute a book of reference for those engaged in the industry as well as for students." In going on with this prelude the author remarks that it was his personal needs which several years ago caused him to compile material that was of assistance to him in the prosecution of his work as a gas engineer, and it is this compilation in the shape of a handbook that he "presents to the profession, with every confidence that it will prove of value and be welcomed." From our view of the situation we are certain that it will so prove and be heartily welcomed. In respect of the section devoted to water gas manufacture the general plan of the volume is "from the consideration of the fuels and materials, to the gasholders." In further reference to his introduction to the water gas chapters, he says, and accurately, "The treatment is throughout practical rather than theoretical, and the chapters on these subjects should be understandingly read by gas makers, foremen and manual operators of the works," a feature which the author considers, and justly so, "of considerable importance." It is also noted that much of "such practical detail of operation has not heretofore been published." The division following is altogether given over to gas distribution, and the final sections deal amply with gas burning appliances "and their attendant data, the whole being treated in the same practical way as the chapters on manufacture." The concluding division teems with theoretical, mathematical and technical matter on the "properties of gases and steam, calorific values, temperature data, testing connections, tables, etc.," which are set forth in eminently practical way. The volume is profusely illustrated, and its typographical makeup leaves nothing to be desired on that score. It might be further said that the general arrangement of the book is in three parts, the first of which has to do with "Water Gas Manufacture;" the second with "Gas Distribution; the third with "General Technical Data." As was said at the commencement of this short review, the Publishers are the D. Van Nostrand Company, of New York; and the price is $4.50 net. The volume may be ordered through us. The named charge does not include conveying expense.

CURRENT COMMENT.—

MR. JAMES E. STACEY, President and General Manager of the Stacey Manufacturing Company, of Cincinnati, O., sailed from Quebec, Canada, last Friday on the steamship "Empress of Britain," to enjoy a well-earned vacation, that will last until the latter part of November. All will join us in wishing for him the best and most enjoyable of travelling luck.

ON July 23d of the current year U. S. Letters Patent (No. 860,753) were issued to Mr. Ernest F. Lloyd, of Detroit, Mich., for an apparatus now known to the trade as the "Lloyd Intensive Gas Scrubber." In so far as one may judge from a close reading of the specifications registered in the Patent Office at least two features of the apparatus are novel, and seemingly useful. As to that we will put the description of it before our readers next week.

THE Denver (Col.) Gas and Electric Company is now charging $7.25 per short ton for coke in the yards. An additional charge of 50 cents per ton is made for putting it into the consumers' cellar bins. The "poor farmers" out that way are complaining that this price is a ruinous one to them; but the said "poor farmers" are not mentioning the fact that potatoes are about 100 per cent. higher in price than was the case a year ago. Maybe the farmers are urging that gas works do not have any use for potatoes, which is certainly true as to works of themselves; but the husky stoker does.

"R. B. S.," writing from Jacksonville, Fla., under date of the 14th inst., incloses the following: "Beginning the first inst., the regulations respecting minimum bills from the Jacksonville Gas Company rule as follows: 'Minimum bills for a consumer using gas through a regular or a prepayment meter will be 50 cents per month per meter, payable monthly. If, however, at the end of a year from September 1, 1907, the aggregate net amount of a consumer's gas bills for gas used through one meter should amount to more than $6, a refund will be made by the Gas Company on minimum bills so that bills for months when the minimum bills were paid shall be for only the actual quantity of gas used at the regular rate; it being understood that no refund on minimum bills will be made unless the aggregate net amount of a consumer's gas bills for gas used through one meter for the year following September 1, 1907, shall be more than $6; refund to be made at the end of a year from September 1, 1907, and at the end of each year from that date. In case of meters installed after September 1, 1907, refund will be made at the end of each year following the installation.'"

MR. LAUREN M. FITCH, of Rome, N. Y., and W. F. Newton and Jas. A. Morris, of Thousand Island Park, N. Y., have filed articles incorporating the Wells Island Light and Heat Company. They propose to construct a gas plant in Thousand Island Park, which is one of the most up-to-date as well as beautiful islands in all that world-famed region.

WE are right well pleased to announce that Mr. H. H. Crowell, of Syracuse, N. Y., has been appointed Engineer, Division of Light, Heat and Power, Public Service Commission, New York, Second District. He formerly held a similar or corresponding position on the engineering staff of the Commission of Gas, Water and Electricity.

THE Meriden (Conn.) Gas Company has completed the extensions to its main system through South Meriden and to the north of Old Colony road.

IF Mr. R. E. Brown is not the right one in the right place there must be something wrong with the Editor of the Minneapolis (Minn.) *News*, for here is what that paper said about him some days ago: "Mr. R. E. Brown, Secretary of the Mankato Gas and Electric Light Company, and upon whom the management depends, is one of Mankato's best citizens. A man of exceptionally rare executive ability, easy to approach, of affable mannerisms, and ever alert to the best mutual interest of his Company and city." May his shadow never grow less!

THE authorities of Lowell, Ind., have sold their municipal electric lighting plant to the Wiley Brothers' Construction Company, of Chicago. A 25-year exclusive franchise also went with the sale. The correspondent who forwarded us this information adds: "The transaction will be welcome news to the public at Lowell, who have grown weary of the poor service given under the management of the municipality. For some time past the plant has been considered far too small to handle the work it is called upon to do with the increase of business, and the lights have been unreliable and very unsatisfactory in general. The city felt constrained to provide better service, which would only be possible by the construction of a new plant, so it was deemed necessary to turn the work over to private interests." And there you are.

THE authorities of Toronto, Canada, have determined that the city shall hereafter not be a bidder at any authorized sales of new stock issued by the Consumers Gas Company—a decision that should please to the full the capitalists of Canada's most progressive and beautiful city.

A New Method of Condensing and Scrubbing.

[A paper read by Mr. Wm. Seymour, of Grand Rapids, Mich., at the Fifteenth Meeting of the Michigan Gas Association.]

Although it cannot be said that no material changes were introduced into gas manufacture in the latter half of the Nineteenth Century, yet it is true that these changes have been almost entirely in the development of the apparatus in use rather than changes in the methods used; but of late years there seems to have come an "awakening" and more attention is being paid to the development of new methods and necessarily to the chemical side of gas manufacture. The cause of this enlivenment may be ascribed to the combined influence of several causes. Among these causes may be mentioned: First, the increased use of gas, due to the rapid development of the gas engine as an economical method of producing power; second, to rapid increase in the use of gas for industrial purposes; third, the sources of profit found in the development of the by-products; fourth, the increasing cost of the material used in the manufacture of present apparatus.

Coal gas, when it comes from the retort, contains several constituents or "impurities" which must be removed in order to put the gas in a condition so that it can be used for fuel and lighting purposes without causing trouble. The most important of these are tar, ammonia, hydrogen sulphide, water vapor, and in some cases naphthaline to some extent.

The first step in the removal of these "impurities" is condensation. On account of the great irregularity in the production of gas, together with the variable influences of most climates, perfection in condensation is hard to attain. Whatever the form of condenser certain precautions are necessary in order to insure successful operation. For example, the apparatus should be protected from the influence of excessive cold, as this may cause the condensation to be so rapid as to remove a considerable proportion of the illuminating constituents of the gas, etc.

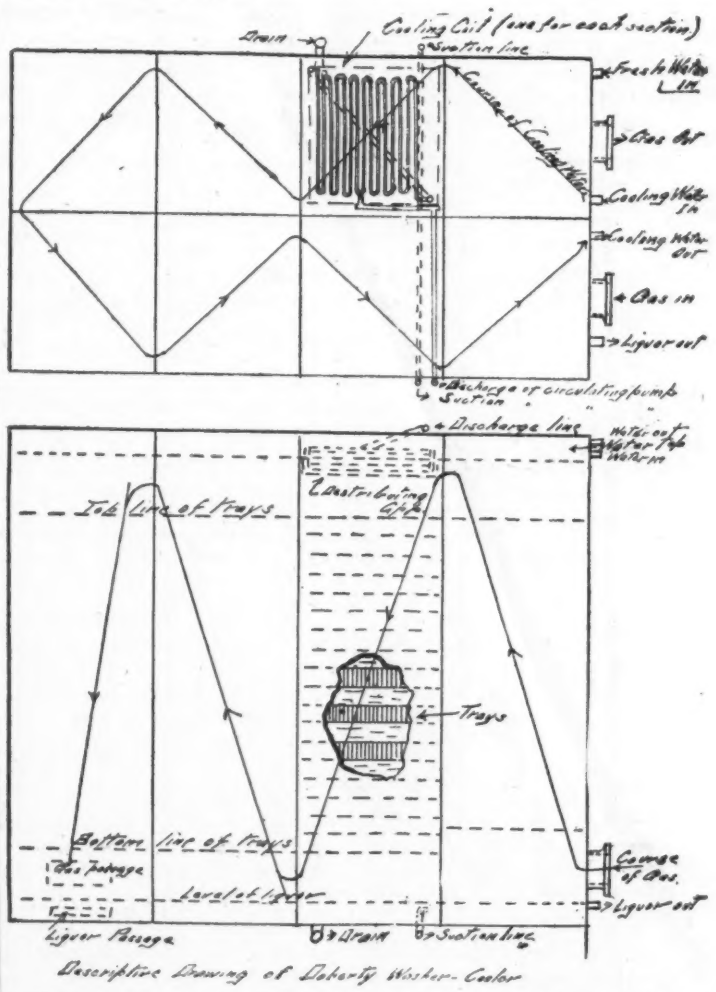
The first practical application of a condenser in the manufacture of coal gas was the placing of a circular pipe in the tank of the gasholder. Then various forms of air condensers were invented until, in 1817, Parks patented a condenser which was very similar in form to the ordinary air condenser now in use. Although the condenser is an apparatus most essential in the manufacture of gas, yet there is no other which until later years has been so little understood. For some time the condenser which could reduce the gas to the lowest temperature in the shortest time was considered the best. The condensers remove a large amount of the tar and water vapor and some ammonia, and also put the gas in condition for further purification.

Almost all of the tar not removed by the condensers is taken out by the tar extractor; then the gas is ready (sometimes after further cooling) for the removal of the ammonia. As water possesses the property of absorbing large volumes of NH_3, it is almost universally used for this purpose. The removal of the ammonia is ordinarily effected by the means of washers and scrubbers. The washbox or washer was one of the first appliances for this purpose. It was objectionable at first on account of back pressure, but the advent of the exhauster removed this objection. However, it was found that a larger part of the ammonia was still retained in the gas even after two or three washings. A weak solution of sulphuric arid was then tried for washing, but as this has a powerful affinity for hydrocarbons the illuminating power of the gas was materially diminished. Passing the gas through a thick stratum of breeze was also tried but failed to be of use otherwise than for removing any tar not previously removed.

The scrubber, as used at present for removing ammonia, was first used for absorbing muriatic acid gas. For this purpose it was filled with pebbles or other materials capable of resisting the action of HCl. Since the scrubber was introduced into gas manufacture various substances have been used for filling, such as coke, wooden trays, etc. The scrubber, with the exception of the rotary scrubber, has undergone but slight alteration since the first few years after its invention. There seems to have been no attempt made to combine the condensing and scrubbing process.

One of the causes ascribed to the recent development of the gas industry is the greatly increasing use of gas for industrial purposes. Producer gas has about one-quarter the heat value of coal gas, therefore about four times as much is needed to give the same results. To purify large volumes of this gas by present coal gas methods would require a large investment in expensive apparatus.

To the demand for a more economical method of washing and scrubbing this gas may be ascribed the invention of the Doherty



Descriptive Drawing of Doherty Washer-Cooler

washer-cooler, and in order to "try out" this washer-cooler it was installed in the plant of the Grand Rapids Gas Light Company. It consists essentially of a sheet steel box divided into 8 sections, and so arranged that the gas enters at the bottom of the first section, goes up, across and down the second, up the third, etc., and finally down through the eighth and out. Each section is filled with wooden trays. The cover of each section is put about a foot below the top of the cooler so as to make a water reservoir in which cooling coils are placed. For each section a small rotary pump takes the liquor from the bottom of that section, forces it through the cooling coils in the reservoir of that section on top and in at the top of the same section through a distributing arrangement. Fresh water is admitted at the eighth section (for convenience the sections are numbered from one to eight in the direction of the flow of the gas) and the excess flows from one section to the next, and finally out at the first section, the water level in the bottom being high enough to supply the pumps and to seal off the openings between the sections for the flow of liquor. The fact that about 30 or 40 times as much heat is transmitted from water to water as is transmitted from water to air is made use of in this washer-cooler, and, therefore, not nearly as much cooling surface is needed.

The first tests made were for the purpose of determining the amount of fresh water necessary for the complete removal of the ammonia under the conditions of temperature, etc., as given in the tests. At the same time the percentage of H_2S in each sample was determined. In these tests the fresh water was started at the rate of 3.72 gallons per 1,000 cubic feet, and two tests made at or near this rate. Then the rate was lowered and two more tests made. After each reduction in rate the gas at the outlet was tested with litmus, qualitatively, for ammonia. It was found to be difficult to get duplicate tests on account of varying amounts of gas, etc. The tests for H_2S in the gas are given in grains per cubic foot, and on account of difficulty in sampling the results cannot, with the exception of the inlet of the first section and outlet of the eighth, be relied upon to any very great extent. In all of these experiments the gas rate was about 65,000 cubic feet per hour. When the rate of fresh water had been lowered to 2.28 cubic feet per 1,000 cubic feet of gas, the qualitative test at the outlet indicated that there was an excessive loss of ammonia. Therefore, under the conditions of temperature, etc., which were present

during the test (about 70° F. outlet temperature and 100° F. inlet temperature) it was found that a fresh water rate of 2.5 gallons per 1,000 was necessary to remove the ammonia. A few conclusions may be drawn from these tests as follows:

WASHER-COOLER TESTS.

Water Rate.	Section 1. Average Temperature. In.	Out.	NH_3 Per Cent	H_2S Content. Gas gr. per 100 Cubic Feet. In	Out.	Liq. Per Cent.	Section 2. Average Temperature. In.	Out.	NH_3 Per Cent	H_2S Content. Gas gr. per 100 Cubic Feet. In.	Out.	Liq. Per Cent.
3.72	104	100	1.24	370	330	.34	100	95	1.03	330	350	.24
3.73	105	98	1.24	460	450	.31	98	90	1.03	450	460	.30
2.79	101	96	1.51	350	330	.19	96	87	1.35	330	320	.22
2.56	97	90	1.67	470	430	.34	90	83	1.52	430	430	.35
2.28	101	96	1.69	340	340	.22	96	90	1.66	340	340	.31
2.08	108	100	1.72	360	360	.27	100	90	1.77	360	360	.27
1.93	97	94	1.83	350	340	.31	94	92	1.82	340	340	.31
1.85	111	102	1.72	330	330	.28	102	94	1.84	330	330	.28

Water Rate.	Section 3. Average Temperature. In.	Out.	NH_3 Per Cent.	H_2S Content. Gas. In.	Out.	Liq. Per Cent.	Section 4. Average Temperature. In.	Out.	NH_3 Per Cent.	H_2S Content. Gas. In.	Out.	Liq. Per Cent.
3.72	95	92	.76	350	360	.24	92	83	.56	360	350	.19
3.73	90	87	.74	460	440	.28	87	78	.51	440	420	.21
2.79	87	85	1.03	320	310	.22	85	87	.89	310	310	.20
2.56	83	80	1.18	430	420	.35	80	76	1.03	420	410	.32
2.28	90	88	1.53	340	310	.29	88	82	1.36	310	310	.29
2.08	90	88	1.66	360	360	.28	88	81	1.54	360	360	.30
1.93	93	89	1.67	340	290	.33	89	82	1.56	290	290	.33
1.85	94	88	1.85	330	300	.30	88	82	1.80	300	300	.30

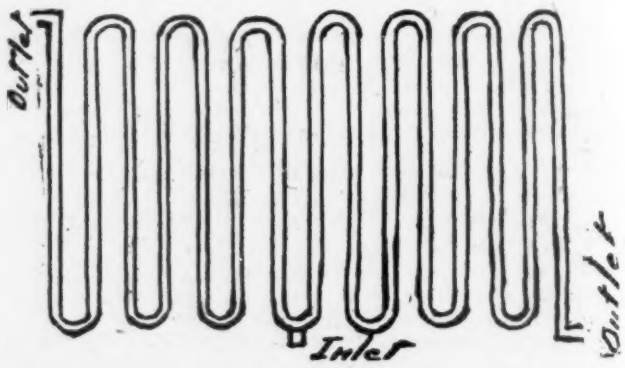
	Section 5.						Section 6.					
3.72	83	82	.39	350	330	.18	83	77	.22	330	320	.09
3.73	78	76	.31	420	420	.17	76	73	.17	420	420	.09
2.79	77	75	.60	310	300	.17	75	72	.39	300	300	.12
2.56	76	74	.73	410	410	.24	74	72	.50	410	400	.18
2.28	82	80	1.07	310	310	.26	80	76	.78	310	300	.20
2.08	81	79	1.19	360	360	.27	79	75	.85	360	360	.22
1.93	82	81	1.30	290	290	.30	81	78	.99	290	290	.25
1.85	82	80	1.50	300	300	.30	81	78	1.17	300	300	.26

	Section 7.						Section 8.					
3.72	77	73	.10	320	350	.02	73	68	.01	350	330	tr.
3.73	73	71	.08	420	420	.05	71	68	.01	420	400	.04
2.79	72	70	.18	300	290	tr.	70	69	.02	290	290	tr.
2.56	72	70	.24	400	380	.11	70	69	.05	380	380	.01
2.28	76	73	.46	300	300	.15	73	72	.10	300	300	.05
2.08	75	72	.50	360	350	.18	72	72	.11	350	320	.06
1.93	78	76	.58	290	290	.18	76	76	.26	290	290	.09
1.85	78	75	.77	300	300	.23	75	76	.38	300	300	.15

It is shown that when the percentage of NH_3 in the liquor has risen to a certain point, determined mainly by the temperature and the percentage of NH_3 in the gas, that the liquor will absorb no more ammonia, and also if the liquid is saturated with NH_3 at one temperature and with given per cent. of NH_3 in the gas, and then the temperature is raised, *other conditions being the same*, the liquor will give up some of its ammonia.

The amount of H_2S removed does not vary as the per cent. of ammonia, but seems to be more a function of the temperature, and undoubtedly is influenced to a great extent by the per cent. of CO_2 in the gas, as where H_2S has combined with NH_3 and then is brought into the presence of CO_2, the G_2S will be replaced to a greater or less extent, depending upon conditions of temperature and mass action.

At this time it was impossible to proceed further with the experiments because the coming of warm weather made it impossible to properly cool the gas in the washer-cooler. Therefore, an investigation of the cooling coils and efficiencies of transmission of heat was made. The coils used for cooling the crude liquor are made up of 15 4-foot lengths of 1¼-inch pipe connected with return bends, the inlet being a "Y" at the middle and the outlets being at opposite corners, thus:



Experiments were first made on two different coils to determine the rate of pumping and drop of pressure through coils:

Experiment on No. 3 Coil.

	Cubic Feet per Minute.	Pressure at Inlet in Inches of Mercury.	Pressure at Outlets. 1. Ins.	2.	Loss of Pressure. Ins.
1.....	7.2	12.0	1.8	1.8	10.2
2.....	6.8	8.8	1.5	1.5	8.3
3.....	5.0	6.5	1.2	1.2	5.3
Avg....	6.3	9.4	1.5	1.5	7.9
		No. 7 Coil.			
1.....	6.6	9.3	1.5	1.5	7.8
2.....	5.9	8.1	1.4	1.4	6.7
3.....	4.6	6.4	1.3	1.3	5.1
Avg....	5.7	7.9	1.4	1.4	6.5
Avg. of 3 and 7.	6.0	8.5	1.4	1.4	7.2

These experiments show that the average rate of 6 cubic feet per minute gave an average drop of 7.2 inches of mercury or about 3.5 pounds.

After these experiments the coils on Sections 1, 2, 3 and 4 were doubled by connecting a coil similar to the first one in parallel with it. Then similar experiments were made on the double coils.

Experiment on No. 3 Double Coil.

	Cubic Feet per Minute.	Pressure at Inlet of Coils. Ins.	Pressure at Outlet. 1. Ins.	2.	Loss in Pressure. Ins.
1.....	7.2	5.4	1.8	1.8	3.6
2.....	8.4	7.0	2.1	2.1	4.9
3.....	10.0	8.3	2.5	2.5	5.8
Avg....	8.5	6.9	2.1	2.1	4.8
		Experiment on No. 1 Double Coil.			
1	7.2	4.5	1.8	1.8	2.7
2.....	8.4	6.0	2.8	2.3	3.7
3	10.0	7.3	2.5	2.5	4.8
Avg....	8.5	5.9	2.2	2.2	3.7
Avg. of 1 and 3.	8.5	5.9	2.15	2.15	4.25

These experiments show a greater average rate of liquor due to less drop in pressure through the coils. So not only was the cooling surface doubled but also the rate of liquor increased, giving more efficient scrubbing.

Experiments were also made at this time to determine the rate of transmission of heat through the cooling coils.

Note.—Owing to the use of river water for cooling water there was deposited on the coils a thin layer of slime which may account for the results obtained being lower than those given for the transmission of heat from water to water.

Experiments on No. 3 Single Coil.

Exp. No.	Rate Crude Liquor Cu. Ft. Min.	Rate Cooling Water Cubic Ft. Minutes.	Temp. Cooling Water Entering. Degrees.	Temp. Cooling Water Leaving. Degrees.	Temp. Entering. Degrees.	Crude Liquor Leaving. Degrees 1.	2.	Area Coil. Square Ft.
1.....	7.2	1.56	72.5	76.0	88	87	87	34
2.....	5.0	1.56	72.0	75.0	88	87	87	34
3.....	7.2	1.56	72.0	76.0	88	87	87	34
Avg.....	6.5	1.56	72.2	75.6	88	87	87	34

Experiment on No. 7 Single Coil.

			Deg.	Deg.	Deg.	Deg.	Deg	Sq. Ft.			
1	4.8	2.06	61.3	64.0	82.0	79.5	79.5	34	347.6	10.2	33.0
2	6.1	2.06	61.5	64.2	83.0	81.0	81.0	34	347.6	10.2	31.2
3	4.8	2.06	61.8	64.3	83.0	81.0	81.0	34	321.9	9.5	29.4
Avg	5.2	2.06	61.5	64.2	82.7	80.5	80.5	34	339.0	10.0	31.2
Avg. of 3 and 7 single coils	5.9	1.81	66.9	69.9	85.4	83.8	83.8	34	340.2	10.0	37.8

Experiment on No. 3 Double Coil.

			Deg.	Deg.	Deg.	Deg.	Deg.	Sq. Ft.			
1	7.9	2.98	70.1	73.0	85.0	84.2	84.2	68	540.1	7.9	36.4
2	9.0	2.98	71.0	74.1	86.5	85.0	85.0	68	577.4	8.5	38.6
3	8.4	2.98	72.5	75.4	88.0	86.8	86.8	68	540.1	8.9	35.4
Avg	8.4	2.98	71.2	74.2	86.5	85.3	85.3	68	552.5	8.1	36.8

Experiment on No. 1 Double Coil.

			Deg.	Deg.	Deg.	Deg.	Deg.	Sq. Ft.			
1	9.0	2.98	82.0	87.4	100.0	100.0	100.0	68	1,005.7	14.8	52.8
2	10.0	2.98	83.5	88.0	102.6	101.0	101.0	68	838.1	12.3	45.9
3	10.0	2.98	83.5	88.9	102.8	101.0	101.0	68	1,005.7	14.8	56.5
Avg	9.7	2.98	83.0	88.1	102.8	100.7	100.7	68	949.8	14.0	51.7
Avg. of 1 and 3 double coils	9.1	2.98	77.1	81.2	94.7	93.0	93.0	68	751.2	11.1	44.3
Av. of all	7.5	2.40	72.0	75.6	90.1	88.4	88.4	51	545.7	10.6	41.1

These experiments show that the average number of B.T.U.'s transmitted by the coils per square foot surface, per degree difference in temperature per hour, is about 40.

This result is low but even at that is from 25 to 30 times as much as from water to gas. When experiments had progressed this far they were discontinued as the increasing amount of coal gas made and warmer weather made it impossible to keep the temperatures where they should be.

The success of the washer cooler as a scrubber cannot be questioned, but as it was found, as originally designed, to be incapable of cooling the gas properly, let us take up, theoretically, the conditions of cooling water, cooling liquor, cooling surfaces, temperatures, etc., necessary for condensation under conditions assumed, which are about those found in the Grand Rapids works. With conditions as follows let us work out the cooling surface needed for each section.

Assumed Conditions.—Eighty cubic feet gas per hour to be cooled from 150° F. to 80° F., temperature entering cooling water 70° F., leaving 140° F. Then assume an equal transmission of heat for each section. To condense 1,000 cubic feet of gas from 150° F. to 80° F. requires 17,500 B. T. U. (Western "Gas Bulletin," No. 201 B), and with an equal transmission of heat for each section the temperatures of the gas at the end of each section are as follows:

		Degrees F.		Degrees F.
Inlet Section	1	150	5	123
Outlet Section	1	146	6	115
	2	142	7	100
	3	138	8	80
	4	131		

Temperatures of cooling water for each section as follows:

		Degrees F.		Degrees F.
Inlet Section	8	70.00	4	113.75
Outlet Section	8	78.75	3	122.50
	7	87.50	2	131.25
	6	96.25	1	140.00
	5	105.00		

To condense 80,000 cubic feet per hour will require 1,400,000 B. T. U. per hour. Then this will require 20,000 pounds or 320 cubic feet cooling water per hour from 70° F. to 140° F. If an equal amount of heat is transmitted in each section, 175,000 B. T. U. per hour per section will be required.

Assuming rate of liquor of 600 cubic feet per hour at 62.5 pounds per cubic foot (37,500 pounds per hour) and specific heat of 1 B. T. U. per pound. Then liquor is lowered 4.67° F. in temperature in each section. Now, taking average temperature of cooling water and average temperature of liquor for the 8th section, we find a difference of 3.3° F. With a transmission of 40 B. T. U. per square foot per degree difference per hour, this would require a cooling surface of 1,325.8 square feet.

Similarly, the cooling surfaces needed, and differences between average temperatures of cooling water and liquor:

Section 8	Average temperature of cooling water	74.4° F.
	Average temperature of liquor	77.7° F.
	Difference between average temperature.	3.3° F.

Cooling surface required with heat transmission of 40 B. T. U. per degree difference per hour 1,325.8 square feet.

Section 7	Average cooling water	83 1°	102.4° average.
	Liquor entering coil	104.7°	
	Liquor leaving coil	100.0°	
	Diff. between average temps.	19.3°	
	Surface needed	226.8 square feet.	
Section 6	Average cooling water	91.9°	112.7° average.
	Entering liquor	115.8°	
	Leaving liquor	110.3°	
	Diff. between average temps.	20.8°	
	Surface needed	210.3 square feet.	
Section 5	Average cooling water	100.6°	125.4° average.
	Entering liquor	127.7°	
	Leaving liquor	123.0°	
	Diff. between average temps.	24.8°	
	Surface needed	176.4 square feet.	
Section 4	Average cooling water	109.4°	128.7° average.
	Entering liquor	131.0°	
	Leaving liquor	126.3°	
	Diff. between average temps.	19.3°	
	Surface needed	226.8 square feet.	
Section 3	Average cooling water	118.1°	140.4° average.
	Inlet liquor	142.0°	
	Outlet liquor	138.0°	
	Diff. in average temperatures.	21.9°	
	Surface needed	199.8 square feet.	
Section 2	Average cooling water	126.9°	139.7° average.
	Inlet liquor	142.0°	
	Outlet liquor	137.3°	
	Diff. between average temps.	12.8°	
	Surface needed	341.8 square feet.	
Section 1	Average cooling water	135.6°	148.0° average.
	Inlet liquor	150°	
	Outlet liquor	146°	
	Diff. in average temperatures.	12.4°	
	Surface needed	352.8 square feet.	

Each section is found to be as follows:

	Square Feet Cooling Surface.	Difference Between Average Temperature.
Section 1	352.8	12.4
" 2	341.8	12.8
" 3	199.8	22.3
" 4	226.8	19.3
" 5	176.4	24.8
" 6	210.3	20.8
" 7	226.8	19.3
" 8	1,325.8	3.3

Average cooling surface..... 382 square feet per section.

The difference in the size of the cooling coils for the different sections under conditions as assumed is very interesting to note. Logically it would seem that the condition of an equal transmission of heat for each section is best, because where there is the smallest drop in the temperature of the gas there is the greatest condensation of illuminants, etc., and this condensation should be slow so as not to take out any more of the illuminants than necessary. Also the condition occurring in some sections, for example the 7th, is worthy of further notice. In this section the gas goes from bottom to top, entering at 115° F. and leaving at 100° F. As the gas leaves at the top at 100° F., therefore the liquor entering the top must at least be not more than 100° F. Now, as the liquor in going through the coils under conditions as assumed (namely, 600 cubic feet or 375,000 pounds per hour) is cooled only 4.7°, the liquor entering the coils can not be more than 104.7°. But the gas entering the section is 115° F., therefore the liquor must go down through the section at 100° temperature, until it reaches a point from which to the end of the section it increases in temperature to 104.7° F. Hence, in this section, other conditions being the same, a lower rate of liquor would be more efficient.

Having seen the conditions present as worked out under these assumptions and as it would be impracticable to design a washer-cooler with these conditions, the next step seems to be to work out the conditions with a practical design.

A total number of 1,400,000 B. T. U. per hour is required and at 40 B. T. U. per square foot per hour per degree difference, this would require 35,000 square feet cooling surface, and at an average difference in temperature of 15° F. the surface required would be 2,333.3 square feet or 291.6 square feet for each section. Therefore, with a fixed cooling surface of 300 square feet per section, cooling water rate of 320 cubic feet per hour, and crude liquor rate of 320 cubic feet per hour without doubt equal rates of cooling water and liquor is the

most efficient, and with other conditions as before, the resulting conditions work out as follows:

From Western "Gas Bulletin," B. T. U.'s per 1,000 cubic feet gas:

Degrees.		Degrees.	
80	11,500	133.8	20,800
90	12,425	139.0	23,300
100	14,800	144.0	25,300
119	17,100	147.0	27,050
....	.....	150.0	29,000

	Cooling Water.		Liquor.		Gas.	
Section.	Inlet. Degrees.	Outlet. Degrees.	Inlet Coils. Degrees.	Outlet Coils. Degrees.	Inlet. Degrees.	Outlet. Degrees.
1	132.25	140.00	150.0	142.20	150.0	147.0
2	125.25	132.25	144.0	137.00	147.0	144.0
3	117.25	125.25	144.0	136.00	144.0	139.0
4	108.25	117.25	133.8	123.80	139.0	133.8
5	92.45	107.25	133.8	119.00	138.8	119.0
6	83.25	92.45	108.0	98.80	119.0	108.0
7	73.75	83.25	99.5	90.00	108.0	90.0
8	70.00	73.75	80.0	76.25	90.0	80.0

These figures show plainly enough that the surface of the coil as designed is entirely inadequate for the condensing required. In conclusion, it may be well to sum up some of the advantages of the washer-cooler.

First, as the transmission of heat from water to water is about 40 times as much per unit surface as from water to gas, only about $\frac{1}{40}$ as much surface is needed, making a great difference in the cost of the apparatus; second, it makes a very efficient scrubber; third, it is easy to clean, as by heating the circulating liquor any naphthaline may be washed down and drained off at the bottom.

There are also other points which might be investigated; for example, it would seem that one or two sections might easily be isolated for a naphthaline scrubber where that is necessary.

A Brief Record of Progress in Fuel Briquette Manufacturing at Detroit.

[Read by Mr. W. S. Blauvelt, of Detroit, Mich., at the Fifteenth Meeting of the Michigan Gas Association.]

During the past five years there has been no little interest manifested in this country in the problem of briquetting various forms of fuel, which, on account of their small size, tendency to disintegrate or smoke producing nature, were not satisfactory to consumers of fuel. This interest in briquetting processes and materials has been stimulated by the high prices which have been obtained for the better grades of fuel in recent years. The technical press and the U. S. Consular Reports have kept us pretty well informed of the progress and success of the fuel briquetting industry in Europe; the daily papers have, in their news columns, told of the coming revolution in fuels, and in their advertising columns have informed us how fortunes could be made by investing in the stock of a secret or patented briquetting process. We are credibly informed that in Europe about 30,000,000 tons of briquettes are made and sold annually; that they make a very satisfactory fuel, comparatively clean to handle, produce very little smoke, do not disintegrate on exposure to the weather, nor are they liable to spontaneous combustion; last, but not least, they are readily sold at a profitable price.

Notwithstanding the magnitude and evident success of the fuel briquetting industry in Europe, it is doubtful whether in this year over 150,000 tons of fuel briquettes will be made and sold in this country.

The development of the fuel briquetting industry is of peculiar interest to manufacturers of coal gas, because coal tar pitch is the only binder which has proven a commercial success; hence, successful briquette manufacturing depends upon a sufficient supply of coal tar pitch at a reasonable price; on the other hand, the success of the fuel briquetting industry insures a much greater market for pitch.

If all the tar produced in the United States in 1906, approximately 100,0000,000 gallons, had been distilled to produce briquetting pitch, the product, about 400,000 tons, would, at a liberal estimate, have sufficed for the manufacture of but 8 or 9 million tons of briquettes, or say one-third the quantity produced in Europe. Another point of interest to the gas and coke manufacturer is that coke breeze can be successfully briquetted. In the report of the briquetting tests at the St. Louis coal testing plant of the U. S. Geological Survey, we read: "The coke breeze briquettes were far stronger than any others made, as is indicated by the results of the compression tests. * * * They burned more like anthracite than bituminous coal."

Early in 1904 the Solvay Process Company determined to install a briquetting plant at the Detroit works in connection with the coke oven plant. At that time the price of tar was very low and there was no market for coke breeze, except at a very low price. Anthracite coal was selling at from $7 to $7.50 per ton, according to the season of the year, and all of the coke made by the Gas Company and the coke ovens of the Solvay Process Company was being sold as fast as it was produced. Thus, having ample supplies of raw materials and reasonable assurances of a good market for a high grade domestic fuel, conditions seemed peculiarly favorable for the commercial success of the venture.

Having had no experience in the fuel briquetting business, it was determined to install such machinery and adopt such methods as had proven successful in European practice. Accordingly, a double compression press with vertical table was imported. Presses of this type were working very successfully in England making briquettes weighing from 5 to 10 pounds each. The capacity of these presses varies with the size of the briquette, from 3 to 10 tons per hour. This type of press is quite fully described in the report of the coal testing plant of the U. S. Geological Survey. It was realized that the large sized briquettes made in England could not be readily sold for domestic use here, and, therefore, multiple molds were provided so as to make 6 briquettes at each compression stroke, the briquettes weighing about 1½ pounds each, instead of 1 briquette weighing about 9 pounds. The use of the multiple molds introduced difficulties which were not entirely overcome until it became obvious that the size was altogether too large for domestic use.

A new table about 1 inch thinner was made, and the 6 compartment molds were replaced by 9 compartment molds, making 2-inch cubes with rounded edges and weighing about 7 ounces each. After several weeks consumed in experimental work, the difficulty of filling the molds uniformly was partially overcome.

Burning tests in stoves and house furnaces, however, proved conclusively that this briquette was still too large for domestic use and was of a form which would not be satisfactory to consumers. Where the flat surfaces of the briquettes came in contact with one another no air would pass, and where the briquettes had their corners opposed an excess of air passed through the fuel bed.

As further reduction in the size of the molds would still further reduce the capacity of the press, it was concluded to abandon further experimental work therewith, and install instead an American built machine of the "eggette" type, capable of producing from 9 to 15 tons per hour of briquettes weighing 2½ ounces each. This machine was installed and the plant completed about August 10th, 1907, since which date the plant has been operated daily. Numerous difficulties in the details of the operation naturally were encountered; these have been gradually overcome during the past 3 months, and bid fair to be entirely eliminated as the knowledge and skill of the operating forces increase. In the operation as carried on at the Detroit plant the raw materials used are bituminous coal, coke breeze and hard pitch.

The breeze used is the coke screenings which pass through ½-inch square openings. As the breeze received is generally quite wet, it was found necessary to pass it through a dryer before it could be used in making briquettes. A rotary dryer was, therefore, installed which has a capacity of about 6 tons per hour, reducing the moisture from 15 per cent. to less than 1 per cent.

The pitch binder used is of such a hardness that it cannot be readily chewed: it is possible, however, that a somewhat softer pitch can be used in cold weather. The pitch is broken in a roll crusher to about the size of chestnut coal and is then elevated to a small bin.

The pitch, breeze and coal are fed by suitable measuring devices from their respective bins to a pulverizer of the swing-hammer type which reduces the size of the pieces till practically all will pass through a screen with ½-inch square openings, and produces a very intimate mixture of the different materials. The pulverized mixture is then elevated and delivered to an inclined rotary heating conveyor into which steam is introduced. In this conveyor the mixture is heated to about 170° F., at which temperature the mixture begins to be somewhat plastic, but, being in constant motion and having no pressure applied, does not become sticky or clog the conveyor. From the lower end of this conveyor the mixture falls into a ribbon screw conveyor where more steam and a little water, heated nearly to the boiling point, are added. If no water be added, the mixture becomes

very sticky and difficult to handle, and the power required to run both conveyor and press is excessive. This ribbon conveyor delivers the mixture, heated to about 200° F., now in the form of a wet, plastic mass, to a chute directly over rolls of the press.

The press itself consists essentially of two heavy cylindrical rolls having cup-shaped molds on the surfaces. These rolls are geared together so that the molds on the two rolls register as they rotate. The plastic mass being fed on top of the rolls fills these molds and the material is compressed as it passes down between the rotating rolls. This press, running at its present speed, 6 revolutions per minute, has a capacity of 9 tons per hour, but there seems to be no reason why it could not be speeded up to produce 15 tons per hour. The briquettes fall out of the molds, as the rolls revolve, upon a belt conveyor where they are cooled sufficiently to withstand handling. From the end of this conveyor they are delivered over a screening chute direct to cars for shipment.

After a long period of constant study and labor, the technical problems connected with the manufacture of fuel briquettes for domestic use, from the materials available, have apparently been successfully solved. The machinery used and the methods employed are now giving satisfactory results. The briquettes produced are hard and tough enough to stand considerable rough usage; they do not disintegrate on exposure to the weather; they burn with very much less smoke than the smokeless coals, and produce no smoke whatever except for a very few minutes immediately after being thrown on the fire; they do not fuse together in burning, and do burn up completely, leaving practically no carbon in the ash.

The very important question of the commercial results of this venture has not yet been answered, but it seems probable that no difficulty will be experienced in selling so excellent a fuel, at a reasonable price, in a market where a large tonnage of anthracite is sold every year at prices ranging from $7 to $7.50 a ton.

The great interest now manifested in the fuel briquetting industry would indicate that, in a very few years, fuel briquettes will become a standard article of commerce in many parts of this country and be as familiar to fuel consumers as they now are in many parts of Europe. In addition to the Detroit plant, briquetting plants are in successful commercial operation at Scranton, Pa., and Brooklyn, N. Y., in both of which fine anthracite screenings and culm, with the necessary pitch as binder, form the raw material. There are also one or two plants on the Pacific Coast.

Experience has shown that the successful manufacture of good briquettes is dependent very largely upon using the proper proportions of pitch and other materials. The percentage of pitch necessary is also found to vary somewhat with different kinds of coal, and this percentage must generally be determined experimentally. It is of prime importance that the mixture, once determined upon, should be kept uniform, as very slight changes in the proportions of the materials have a marked effect upon the quality of the finished product.

When once thoroughly developed and organized, the process is not a difficult one, as is shown conclusively by the large number of successful plants scattered over the Continent of Europe. One reason for the failure of the many attempts that have been made to introduce briquetting into this country during the past 20 years is that those who undertook the work had not a full realization of the practical difficulties of adapting the process to the new fuels, and other technical and commercial conditions in this country, and of the amount of capital required. Each undertaking was without the benefit of previous experience of manufacture under American conditions, and the funds that were available for the purpose were exhausted long before the details had been worked out and sufficient experience had been accumulated to insure success. The plant at Detroit has been installed not only to develop the successful manufacture of briquettes at that point, but also to advance the industry to a permanent basis in this country, in order to develop the consumption of coal tar pitch. The experience gained there is, therefore, at the service of those undertaking similar enterprises, and it is hoped that by free interchange of experience obtained in both failures and successes the development of the industry may be rapid, and that, now that there are several plants actually in commercial operation, under the varying conditions of their localities, the industry may before long obtain a standing justified by its undoubted value to the industrial world.

It is guaranteed that the new water gas equipment for the Nashville (Tenn.) Gas Company will be ready for operation by December 15th.

Gas Firing of Potters' Kilns.

The *Journal of Gas Lighting* says that at a recent meeting of the English China Manufacturers' Association, Mr. Arthur Woolley, of Longton, gave some interesting particulars with regard to experiments which he has made in firing kilns and ovens with gas.

Dealing first with the kind of gas to be used, the author said that, in his opinion, Mond gas was not suitable for the requirements of pottery manufacturers. They needed a gas with a highly luminous flame, so bright that it must almost be like electric light. The more luminous the flame, the more perfect the gas for potters' ovens. He did not think there was any difficulty in applying gas firing to kilns; in fact, it was easy to use it with the ordinary or travelling kiln. The difficulty in applying gas firing to ovens had been that in an oven there was a large space of dead matter which had to be fired, and whether coal or gas was used it required the same heating properties to get through this. Gas was of no more value than coal for getting through a mass suddenly; therefore the chief thing was to have perfect radiation. He had been working on this matter for several years, and it was now an absolutely assured success from almost every point of view—economy of fuel, preservation of brickwork, purity of color, general cleanliness and an almost total absence of smoke, if properly managed. He had received valuable assistance in his experiments from Mr. Fell, of Longton. In conjunction with Mr. Fell, he had made various experiments, and had secured a temperature equal to that necessary for the making of steel—namely, 2,000° C. The highest temperature required for a bisque oven was from 1,350° to 1,400° C., and this could be easily attained by gas, and much quicker than by present firing methods. He believed the gas firing process could be applied to existing ovens without any expensive alterations. All that was required was to take out the mouths and in their places put producers. The conditions were exactly the same all the way through, with the great recommendation that with care and attention they were absolutely constant. So far as glost ovens were concerned, the matter was beyond the experimental stage; and, as regarded bisque ovens, for 10, 15 or 20 hours they could have hot air, devoid of flame, passing through the oven, gradually drying the ware and heating the oven. Afterwards they could introduce the gas flame, increasing the temperature as needed, or keeping a constant heat. They could either keep a certain temperature for 10 to 20 hours, or they could increase it at will. As producers were placed in each mouth, if, by oversight or carelessness, any part of an oven was firing too quickly, that part could be shut off for the time being without interfering with the process of firing in another part. There had been invented and patented a system for regulating the middle by an arrangement which completely shut out, if required, any gas from passing up the middle, but still firing the outsides, or *vice versa;* and by this system they could either enlarge or reduce the well hole. He did not say they had perfected the process; indeed, he felt they were simply on the fringe of it. As to the cost, he believed they would be able to place on the market an arrangement within the reach of every manufacturer. He did not care how old or what construction an oven was, it could be adapted to work as successfully as one specially built. The advantages were many. He suggested there would be a saving in fuel of 50 per cent.; a saving of 30 per cent. in the period of firing, and a reduction of 95 per cent. in smoke; and, as regarded the firing of the ware, he thought he could safely say they would get a better oven after gas than coal. In his experiments he had reached perfection with both colors and gold. He regretted they had not some organization which would take up a matter of this kind and carry out the experiments, instead of leaving them to individual firms.

The Study of Oil Deposits.

A very interesting Bulletin on "The Study of Oil Deposits" has recently been issued from the publication division of the U. S. Geological Survey. The following specimen chapter goes to show how well the subject is handled—it may be here noted that copies of the work complete can be obtained without charge, on application to the Director U. S. Geological Survey, Washington, D. C.:

"A knowledge of the conditions that govern the accumulation of petroleum in pools is of the greatest practical value to the oil men, and investigations to determine these conditions have been carried on for a number of years by the geologists of the United States Geological Survey in various oil producing districts. The results of some

recent work of this kind in Pennsylvania, Ohio and West Virginia, by Messrs. W. T. Griswold and M. J. Munn, have just been published by the Survey as Bulletin No. 318. The investigation of Mr. Griswold and Mr. Munn involved the solution of two important questions: First, what are the physical laws under which oil accumulates in pools; and second, how many of the conditions of this accumulation can be determined prior to actual test by the drill. The area selected for study was that portion of the Appalachian oil field comprising the Steubenville (Ohio-West Virginia) and the Burgettstown and Claysville (Pennsylvania) quadrangles, within which lie most of the white oil producing sands of the Appalachian field. This area, about 680 square miles in extent, has been tested by numerous wells and includes large and important developed oil pools from the Berea, the Hundred-Foot, the Gordon, the Fourth and the Fifth sands. Records of the conditions discovered by the many test wells were collected, and a map of one of the principal oil producing sands in each quadrangle was drawn to represent the sand as if all of the material above it had been removed and its upper surface exposed to view. From the facts thus assembled general laws applicable to the different oil accumulations have been deduced. The chief factors in the accumulation of oil are the geologic structure of the oil bearing rocks and the salt water contained in the different producing sands. These sands vary greatly in the extent of their saturation with salt water. The younger sands, or those nearer the surface, comprise much larger areas that are completely saturated, and the saturation decreases downward with each succeeding sand. The Fifth, the deepest sand from which oil has been produced within the region, contains salt water only in very small areas in the very lowest spots.

"The oil has accumulated in different places with reference to the high and low points of the rocks, the place of accumulation depending upon the quantity of salt water contained in the sand rocks. In those sandstones that are completely saturated the oil is found on high places; where the oil sands contain water only up to a certain height around the side of a structural basin—as if it were a bowl half filled with water—the oil lies at the top of the water and extends around the basin in lines at the same elevation, following the strike of the structure; where there is little or no water in the sands the oil accumulates in the syncline or lowest part of the oil sand. The possibility of accurately mapping an underground sand without the use of many well records was determined only for the area investigated, for the accuracy of the results of such work depends on the degree of parallelism that exists between the different geologic strata outcropping at the surface—that is, on the regularity or irregularity of the relations between the strata outcropping at the surface and the oil sands. Before wells are drilled it is, of course, impossible to map a sand, or even to say that it exists; but if in any area test wells drilled not over 3 to 5 miles apart have penetrated the same sand, the high and low spots of the sand and the slopes between these spots may be mapped with an error not greater than 10 or 20 feet, if the outcropping strata accurately indicate the structure. The Bulletin just published explains the methods of work and includes detailed maps of the quadrangles investigated."

Recent Advances in Artificial Lighting by Means of Arc and Vacuum Tube Electric Lamps.[1]

Light from Gases and Vapors.—Whenever a gas or a vapor is made luminescent, certain definite wave lengths of light are always given off and a definite spectrum is always obtained for each gas or vapor. When the atoms or molecules of a gas or vapor are caused, by electrical means, to move in such a manner that light is produced, heat also is produced as a result of the electrical conduction; but the temperature is not related to the quality of the light except in the case of metallic vapors, when a certain temperature may be necessary for the existence of the vapor in quantity. This phenomena is the reverse of that generally observed in the case of incandescent solids, where the light is directly related, both in color and amount, to the temperature. Gases and vapors may be made luminant by electrical stress in vacuum tubes and by electric arcs.

Direct and Alternating Current Arcs.—The spectrum of an arc is that of the vapor of the negative electrode, and is independent of the material of the positive electrode, except as materials held therein enter the arc vapor as a result of the high temperature attained. An arc is essentially a direct current phenomena, and except under definite conditions cannot exist with an alternating E. M. F. Even when so existing, the alternating current arc is formed by a succession of separate direct current arc streams. At the end of each half wave length, the current dies away, and with it dies the vapor stream. The next half wave of E. M. F. having a reversed direction necessitates that the current, and therefore the vapor stream, should pass in the reverse direction from that of the first half wave length. The continuity of the arc to the eye is broken if the supply voltage is not high enough to cause a current to pass through the residual vapor between the electrodes. The voltage required to jump a spark across the gap between terminals decreases with an increasing temperature, while the voltage across an arc increases with the arc temperature and therefore with the boiling point of the electrode material. Now with electrodes of certain materials the voltage across an arc becomes equal and even higher than would be required to jump a spark between the electrodes at the temperature of the residual vapor. Such electrodes allow the apparently steady maintenance of an arc between them with alternating current. The arc streams, however, are separated and continually reversing with a frequency corresponding to that of the supply current. The stroboscopic effects of alternating current arcs are the result of this reversal of vapor streams. Carbon is such a material as above described, and the development of an alternating current lamp from the old direct current types was possible without much experimenting and before the theoretical considerations for the maintenance of alternating current arcs were thoroughly understood or widely appreciated.

The old direct current lamp was first improved by inclosing the electrodes in a more or less airtight globe. This reduced the consumption of carbon electrodes and the cost of attendance, but at the expense of efficiency of actual illumination. The esthetic effect was materially improved by the diffusing action of the inclosing globe. Where once it was possible to see only the old open arc itself, on account of its great intrinsic brilliancy, with the inclosed arc it became possible to distinguish the environment.

The use of the inclosed arc has become so common that the lamp need not be further considered here. Indeed, there is promise that it will be superseded by a newer type of arc lamp hereafter described.

Luminous Arcs.—In an ordinary arc between carbon electrodes, the light comes from the tip of the incandescent electrodes, and comparatively none from the vapor stream itself. In the development of the new lamps it was attempted to increase the light-giving power of this non-luminous vapor by introducing some substance not carried by the common carbon electrodes. There are two ways of doing this: (1) By using in a direct current lamp negative electrodes of a material whose vapor gives a highly luminous spectrum; (2) by employing electrodes of such refractory materials as will give a very high arc temperature and cause to be fed into the arc vapor, by heat effects, materials which may be carried by the positive electrode, but which are not serviceable for the material of electrodes of the first class, though increasing the light-giving power of the vapor. Lamps working on the latter scheme are universally known as "flaming arcs," while those working on the first idea are variously called "metallic," "magnetite," "titanium," or even "luminous" arcs.

The Flaming Arc.—Carbon arcs have proven refractory enough to secure the temperature necessary for vaporizing the foreign substances which it was desired to introduce into the arc vapor to increase the light. If we have a carbon negative and a positive of carbon impregnated with or containing a core of calcium fluoride or borate, then the calcium vapor enters the arc vapor and is heated to the arc temperature, becoming highly luminous. Such material is preferably so fed in from the positive electrode, as this is the hottor. Here the efficiency of light production depends on the temperature of the positive electrode which controls the vaporization of the luminescing material. If the positive electrode is large and consumes but slowly, the efficiency decreases as the amount of luminescing material evaporated is necessarily smaller. Therefore a rapid consumption of the positive electrode is necessary. This positive electrode may be of a good grade of carbon, with a core of the calcium salts. Often the core becomes so large that the carbon is a mere outer shell, and in this case the salts must be mixed with considerable carbon for necessary conductivity. The arc flame of these lamps, used with direct current, takes a more or less distorted conical shape, having its base about the positive electrode. This flame has a brilliant luminous core of the arc stream proper, composed of the decomposed vapors of the calcium salts. About the arc stream is the zone in which the materials are recombining with oxygen, fluorine, etc., and around this zone is the slightly opaque cooler product of recombination, in a finely divided form, giving the appearance of a slight smoke or of fumes.

1. *Engineering News.*

In some American designed lamps the familiar arrangement of electrodes, one over the other, is maintained. Many American made lamps, in fact, those most commonly seen, employ converging electrodes with the arc playing between their tips. As a type of these lamps those made on the Beck German patents may be briefly described. The electrodes of these lamps carry a rib or long fin, which supports the carbon, resting on a metal stop. As the carbon burns away the rib, of course, burns also, and the electrode feeds by gravity. The arc is drawn by a plunger disk, operated by a series magnet, which forces the electrode holders apart. This is shown in Fig. 1. In some lamps the negative carbon alone rests against a stop, and the positive is suspended in its guide frame by a compensating chain attached to the negative, so that, as the latter burns away the positive also is lowered. In some forms, also, the rib on the carbon is absent. A starting resistance (or an inductance coil in the alternating current types) is included in the circuit to avoid a dead short circuit in starting. In some lamps magnetic blow-out coils with properly located cores repel the arc downward from the electrodes in a fan or bow. In all these forms the mechanism is very simple. The general appearance of the converging electrode type is shown in Fig. 2. The diameter of the electrodes for all flaming arc lamps is

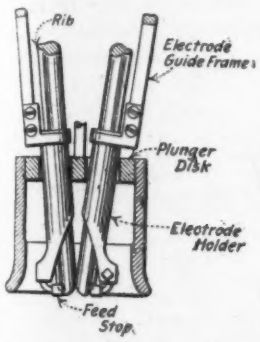


Fig. 1.—Lower Mechanism of Flaming Arc Lamp; Beck Flaming Lamp Co.

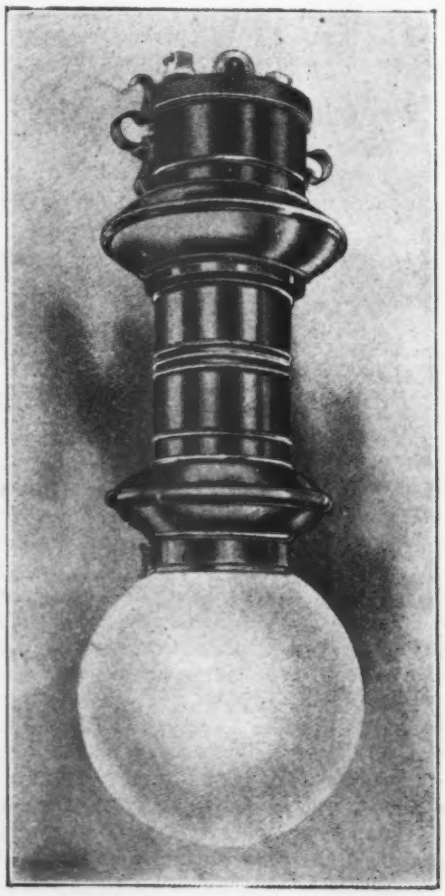


Fig. 2.—General Type of Flaming Arc with Convergent Electrodes; Beck Flaming Lamp Co.

necessarily small in order that the supply of luminous vapor may be properly maintained. This, with the necessity of an open arc, makes the life of a single trimming limited from 8 to 17 hours, the latter figure being possible with very long electrodes.

The application of flaming arcs has been more extensive in Europe than in America, on account of greater cost of current and a lower cost of carbons and labor in all the European countries. Their widest use in this country is in situations where their brilliancy may attract attention.

The flaming arc lamp may give, at about 400 to 550 watts power consumption, a mean spherical candle power of, roughly, 850 to 1,100, a maximum downward candle power of 1,800 to 3,300, and a mean lower hemispherical about 1,600 to 2,000-candle power. This yields a power consumption figure of about 0.7 to 0.4 watts per mean spherical candle, English units. These figures are given from an analysis of curves and figures issued by various manufacturers, and are to be taken as indicating only approximately the lamp performance which depends to a great extent on the size, thickness and quality of the lamp globe.

Metallic Arc Lamps.—The development employing negative electrodes made from materials giving a brilliant arc vapor seems to be far less limited in field of application than the "flaming arc" just described. The possibilities are so promising that it would not be surprising were the present common inclosed arc lamp for street uses, to a great measure, superseded by these lamps on account of somewhat higher efficiency and smaller maintenance expenses.

A directly comparative and complete series of tests showing the relative utilities and efficiencies of the "metallic," "open" and "inclosed" types of arc lamps is not available, and only rather general comparisons can be made. Metallic arc lamps giving about 650 to 700-candle power maximum on 310 watts energy supply, have been used to replace inclosed arc street arcs of 400 to 600 maximum candle power on 480 watts, with improvement in the street illumination.

The manufacturers of arc lamps claim that the common demand is for street lamps giving a white light. Such a demand, at present, limits the use of substances available as negative electrodes to those whose vapor spectrum is fairly well distributed and whose light is necessarily "white." These substances are of the iron group—iron, titanium, tungsten. The range of substances is narrowed still further when the characteristics of the electrode are considered: (1) It must be a fair conductor, and (2) it must be long-lived. These necessitate the use of an oxide or a carbide. As these materials, after vaporization, redeposit as a solid, the lamp must be arranged as an "open" arc, with special ventilation.

The researches of Dr. C. P. Steinmetz showed that magnetite or magnetic iron oxide (Fe_3O_4) was the most convenient and available basis for an electrode, though its light giving quality was inferior. The addition of a ceitain amount of titanium oxide gives great brilliancy and efficiency to the arc. A certain predetermined amount of chromium oxide is added, which has the effect of restricting undue production of titanium vapor and consequently promotes a longer life of the electrodes, although at a slight sacrifice in the efficiency of light production.

The positive of this kind of lamp is a metal, usually copper or a copper alloy, which is consumed only very slowly. At first this may seem anomalous, but the explanation is simple. As this lamp arrangement is adapted only for direct current, the arc stream is always uni-directional and towards the positive electrode. No material is carried, therefore, from the positive by the arc stream, and if the material and design are properly manipulated the heat at this positive will be transmitted and radiated as fast as developed. A slight coating of conductive slag also protects the hottest portion of the metallic surface from rapid oxidation.

Laboratory or experimental alternating current magnetite arc lamps have been built. Magnetite, titanium and most other metal oxides are such electrode materials as require a sparking voltage, at the temperature of the arc vapor, considerably in excess of that required to maintain an arc. This phenomenon was noted in the general discussion of arcs. On account of this characteristic of the direct current luminous arc electrode, they do not allow a steady arc to be maintained on alternating current. Theoretically it should be possible to construct an alternating current lamp with two oxide electrodes and a single copper negative electrode. This would work on the principle of the mercury arc rectifier. However, titanium carbide is one of those materials which will permit of a steady arc on alternating current. It is not as incombustible as magnetite or the metallic oxides, but is stable enough to promise future development. Here each electrode acts alternatively as positive and negative, and a non-burning positive of copper or alloy cannot be used, as in the direct current form.

The commercial form of magnetite arc lamp has been developed on two distinct lines in this country; the one with the negative electrode above the positive, the other with these relative positions reversed. The exponents of each line of development claim especial advantages of each arrangement.

The general appearance and arrangement of parts of the General Electric underfed lamp is shown in Figs. 3 to 5.

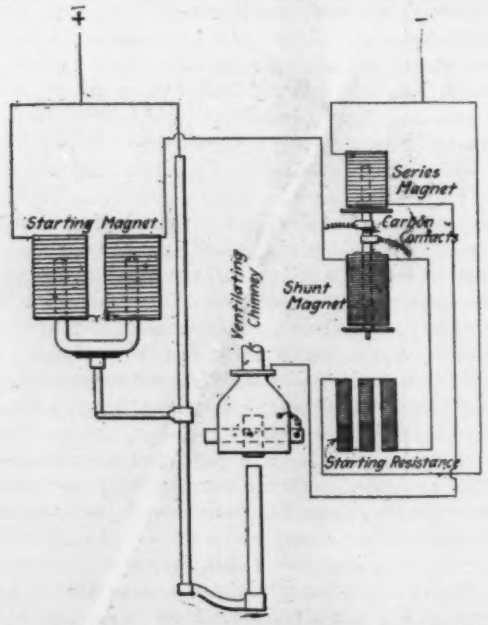


Fig. 3.—Diagrammatic Arrangement of the Parts of the General Electric Type Metallic Arc Lamp.

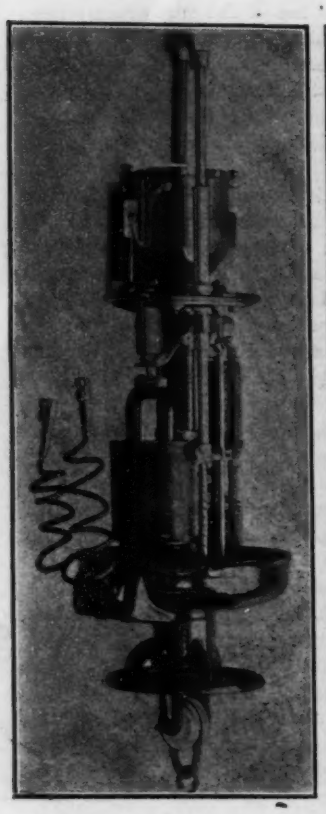


Fig. 4.—Casing Removed.

Fig. 5.—Casing in Position.

The General Electric Metallic Arc Lamp Assembled.

When the lamp is started the current passes through the starting or feeding magnets and the carbon contacts of the series and shunt cut-out coils, through the starting resistances to the line. The "starting" or "feeding" magnets lift up the negative electrode until it touches the positive, when current must flow through the electrodes and the series cut-out magnet, as indicated by a glance at Fig. 3. This weakens the feeding magnets until the negative electrode falls, until supported by a clutch, thus drawing the arc. When the negative electrode is consumed so that the arc voltage has reached a certain point the shunt feeding magnet becomes strongly energized enough so that it closes the carbon contacts. The starting magnets are now again taking current and bringing the electrodes into contact. The lamp will now repeat the first operation. This action also tends to break up any slag or crust formed about the edges of the negative electrode. It will be noted that here the use of air currents is utilized to carry off the light solid products of the arc and incidentally to steady and center the arc.

Without such a ventilating system the accumulation of these oxides is rapid and interferes with the proper distribution of light.

The brighter portion of the arc is near the negative electrode, and the makers of the overfeed type claim that the shadow under the underfeed lamp is larger and denser than when the electrode is fed from the top. This underfeed necessitates a larger globe and a thicker electrode or a shorter life than the upperfeed. With the overfeed lamp developed by the Westinghouse Company, the difficulty of the light oxide accumulating very rapidly has been obviated by arranging the ventilating system so that a current of air comes down around the negative electrode, and another scours over the reflector surface, and these both pass up a chimney, substantially as shown in the diagram, Fig. 6. It is stated that these air ducts have

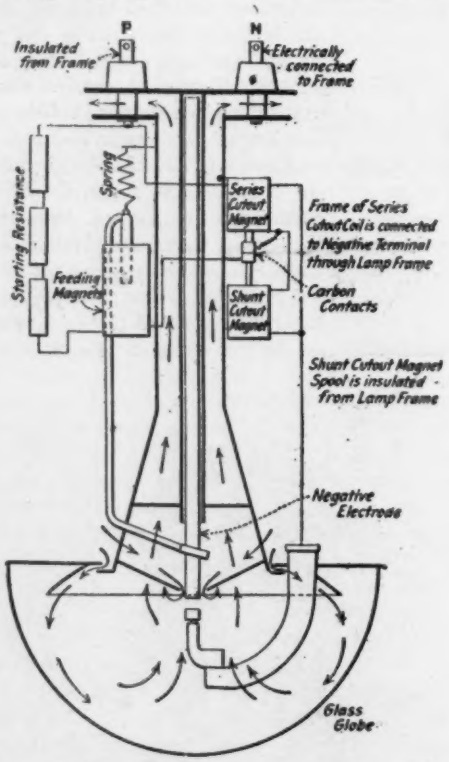


Fig. 6.—Diagrammatic Arrangement of the Parts of Westinghouse Metallic Arc Lamp, Showing Direction of Air Currents.

been carefully designed so that the highest winds cannot reduce or reverse the drafts. The steadying effect of these air currents makes it possible to maintain the arc voltage more uniform, thereby increasing the efficiency by reducing the average of watts consumed.

The general arrangement of the parts of the Westinghouse lamp is shown in Figs. 6, 7 and 8. The electrodes, when the current is off, are separated, and the cut-out contacts are closed. The armature of the feeding magnet is connected to a dash pot having a graphite self lubricating plunger which is designed so as not to stick under the most severe conditions.

When the current is turned on it energizes the feeding magnets, which pull down their armature and bring the electrodes into contact. This allows current to pass through the series magnet and the series cut-out is lifted from the shunt cut-out contact, thus breaking the circuit through the feeding magnets. Accordingly the armature is released and the arc is drawn. As the negative electrode burns away the arc lengthens and the voltage across its terminals rises until a sufficient current passes through the shunt magnet so that it raises the shunt cut-out contact until it touches the series contact. Then the feeder magnets are energized and the arc fed until its normal length is re-established.

Rectifier System.—Metallic arc lamps were first operated by modifications of the old style, series arc generators, notorious for their inefficiency. After considerable experimenting, mercury arc rectifier sets were designed for furnishing the necessary direct current at constant amperage from constant potential alternating current supply. The set consists essentially of a constant current transformer, a mercury rectifier, a switchboard, and necessary instruments, etc. The general arrangement is shown in the diagram by Fig. 9 and a view of a switchboard panel by Fig. 10.

The constant current transformers are, in general, the same as those developed for series alternating current lighting systems. In

Fig. 7.—With Cover Raised.

Fig. 8.—With Cover Closed.

The Westinghouse Metallic Arc Lamp Assembled.

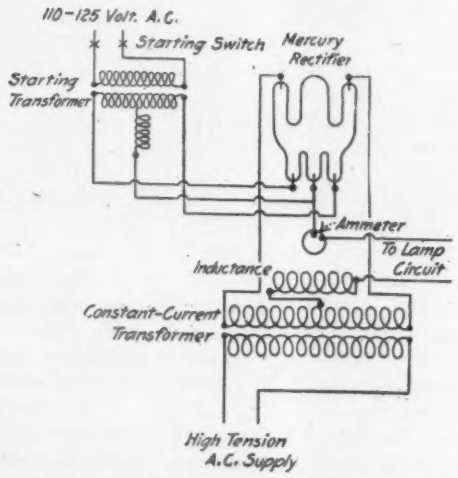


Fig. 9.—Diagram Showing General Arrangement of Mercury Arc Rectifier System for Series Metallic Arc Lamps; General Electric Co.

the General Electric Co.'s system a reactance coil inclosed in the same case with the transformer is inserted in the direct current circuit to reduce the pulsations in the rectified uni-directional current. Additional inductance also may be placed in the alternating current circuit of the rectifier tube to dampen "kicks" in that circuit due to line disturbances.

In this system a starting transformer is used to supply a low-potential split-phase current to the starting anode of the mercury arc rectifier. A small auxiliary arc is started which ionizes the vapor of the tube and allows the main arc to establish itself at once without the high voltage necessary to start the arc between the main electrodes.

In the Westinghouse mercury arc rectifier system the constant current transformer is designed so that there is self induction enough in the windings to store a sufficient amount of energy so that the fluctuations of the pulsating direct current may be properly damped. This makes the current through the rectifier constant enough to prevent flickering of the street lamps. In this system the starting transformer, also, is omitted.

To secure a satisfactory length of life of the mercury arc rectifier tubes, it is necessary that their temperature be kept within certain values. This may be accomplished in two ways:

(1.) By a blast of air delivered through a proper opening in the switchboard, from a blower set.

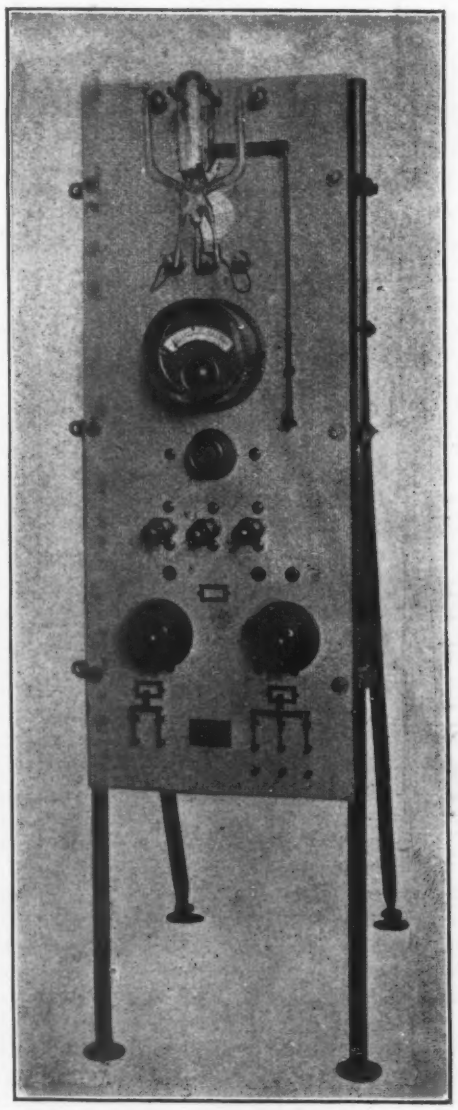


Fig. 10.—Switchboard Panel Arranged for Mercury Rectifier System for Series Metallic Arc Lamps; General Electric Co.

(2.) By immersing the mercury arc tube in a bath of oil so designed that the convection and conduction keep the temperature at proper values.

It is not necessary here to present a description of the mercury arc rectifier itself or a discussion of its well-known principles. For this system some minor mechanical modifications of the tube have been found desirable, so that it does not resemble the older styles. Under normal conditions a tube life of about 700 hours has been attained.

The General Electric system has been installed in Poughkeepsie, N. Y., for about 2 years, and has proven highly satisfactory. As this is a typical installation a few points of interest may be given. At a first glance it might seem that the city was using old open arcs, but a moment's observation shows important differences at once. First, while the light of a street lamp seems intense, yet it lacks the harsh glare of the old open arc, and it is soon noted that one can distinguish objects beyond the lamp far more than could be done with the open types, and nearly as well as with the inclosed arcs. Tests show that the maximum reading distance is 25 per cent. farther from the arc than with inclosed arcs, and the distribution is fairly uniform as the lamp is approached. The shadows are sharp, but the unusually harsh contrasts of the older open arc systems are absent. Then, again, there is a pleasing steadiness in the light.

The Poughkeepsie installation if open to a single criticism—that the globes are not sufficiently sand blasted. This gives opportunity for two improvements; the general diffusion could be bettered and the nearer shadows softened. The small and brilliant areas could be further prevented from being impressed on the retina of the eye, lessening the local fatigue and unpleasant strain noticed by sensitive eyes, at least. The accompanying table shows some interesting comparisons of this installation;

TABLE I.—*Poughkeepsie Light, Heat and Power Company—Street Arc System—Operating Data.*

Number of circuits	6
Number of street lamps	325
Number of switchboard panels	7
Voltage of constant potential.	
Steam system	4 306-horse power water tube and 2 150-horse power horizontal tube boilers. 2 reciprocating engines. 1 Curtis turbine.
Coal burned	Soft coal, at $3.30 per ton.
Chimney draft.	
Watts per lamp	310
Watts per lamp, old system	480
Cost renewals, trimming, repairs	$4.89 per lamp, year.
Contract price paid by city	$84 per lamp, year.

The Cooper Hewitt Mercury Vapor Lamp.—This lamp has found extended use since its introduction in 1903 in places where a very low operating cost, and the tabular form, with low intrinsic brilliancy and good diffusion, are of greater importance than having a natural color value of illumination. As the lamp has become rather more simplified than when first introduced, and as it is at present the most efficient commercial light source, it will be described and its use briefly outlined.

The complete lamp for direct current comprises the tube and holder, and a small set of inductance and resistance coils connected in series with the tube. The tube is of a special glass, carrying an iron electrode at the upper or positive end, and a mercury electrode at the negative or bulb end, connected with the outside by platinum wires sealed in the glass. The tubes are made in lengths of 21 and 45 inches, of a diameter of 1 inch for candle powers of 300 and 700, respectively, for the general groups of voltages about 110 and 220, respectively. The tube can be adapted for any commercial voltage, though the candle power changes slightly for different voltages. Only a small quantity of mercury is contained in the bulb at the negative end. The tube is exhausted and sealed similar to Crookes vacuum tubes.

The tube is supported by two clamps, fastened to a "lamp rod," which is parallel to the tube. The lamp rod is pivoted to the main stem, which is screwed into the ceiling crowfoot. The auxiliary coils, etc., are also supported by the stem and covered by a metal canopy. In some cases a reflector is fastened to the lamp rod. All this is shown by Figs. 13 and 14.

The mercury tube, considered alone, has a peculiar characteristic whereby it experiences momentary increases of resistance of sufficient magnitude to break the continuity of the arc. This seems to disappear with a current of over 4 amperes, and with smaller currents when the negative electrode becomes hot. With the 3.5-ampere lamp, the commercial type, it has been found necessary to introduce inductance in series with the tube so that the magnetic energy stored opposes and overcomes the tendency to reduce the current. This effect of increasing resistance tends to become cumulative, as a certain sized inductance has been found to keep the vapor stream continuous for a few seconds, while a larger one is necessary to maintain it for a few minutes or an hour, and a still larger one for absolute continuity.

Roughly speaking, an increase of induction in the circuit of 10 times lengthens continuity of action about 1,800 times.

Cooper Hewitt lamps were formerly started in some types, by a high tension apparatus, which has been discarded, though perhaps only temporarily. While the high voltage momentarily required was confined to the lamp and did not affect the supply voltage, yet a higher degree of insulation and costly workmanship was demanded in the lamp itself for this type. The whole lamp was, therefore, more expensive and less simple than the present commercial forms. In the types now for sale the tube is tilted and the mercury in the tube poured in a small stream between the two electrodes. A short circuit is prevented by an auxiliary resistance. When this stream is broken by returning the tube to normal the arc is started and the lamp put into operation. This tilting is accomplished by a chain attached to the upper end of the lamp rod, or by a solenoid on the stem at the pivot joint of the lamp rod.

It is impossible to work the simple direct current tube on alternating currents on account of the phenomenon noted under alternating current arcs, mercury being one of those electrode materials with which the voltage consumed in an arc is much less than the sparking voltage at the temperature of the arc.

The tube for the alternating current lamp is similar to the direct current type, except that the upper end carries two positive electrodes and a small starting electrode (connected through resistance to one positive).

The starting is accomplished by tilting the tube by a chain. The mercury flows out of the bulb as in the direct current type and strikes the starting electrode, but skips the positive electrodes, which are in pockets on the upper half of the tube. On account of the irregular flow of the mercury about the starting electrode it makes and breaks the circuit, starting an arc. If the arc be started at such a point of the alternation of current that the mercury column is the negative electrode, then the arc will continue between the mercury and (alternately) the starting electrode and that positive to which the starting electrode is not connected. On account of the resistance connected between the temporarily inactive positive and the starting electrode the arc will not be maintained on the starter, but on both positive terminals alternately. If there were no resistance between the starting electrode and that positive electrode to which it is connected, supposing the arc to have just been started, and the tube still tilted, should the mercury touch the starting electrode again the arc would fail, as a metallic path would be placed in parallel with it.

As the candle power of the mercury arc varies considerably with variations of voltage, some auxiliary regulating apparatus needs to be included in the circuit. A "ballast" resistance has been provided, quite similar to that used with the Nernst lamp. An iron wire is wound on a porcelain pencil and the whole sealed in a glass tube through which the terminals pass. Iron has the property of greatly increasing its resistance by passage of relatively small current. At 500° C., the working temperature of the "ballast," this effect is enormously accentuated. The coil is placed in series with the arc, and is so designed that a slight decrease in the current causes such a decrease in the voltage drop across the terminals of the coil that the remaining portion of the voltage impressed on the lamp remains more nearly constant.

The mercury lamp is the invention of Mr. Peter Cooper Hewitt, of New York city, but the present commercial forms were largely developed by the Cooper Hewitt Electric Company, 220 West 29th street, New York city, one of the Westinghouse interests.

The mercury arc lamp has found its widest application in various industrial and commercial plants. On account of the comparatively large candle powers and peculiar colors it is limited to such places.

Those who have not worked under the light are the strongest objectors to its green color. It certainly has a strangeness at first; color values are upset, and persons take on a ghastly pallor. However, many manufacturers and shop operators state that workmen, clerks and draftsmen, alike, soon become used to the absence of red rays and that the eyes apparently are less fatigued by the same length of time in close application to fine work than with those illuminants yielding more red rays.

The current consumption for a given amount of light is particularly economical with the use of the mercury lamps, being claimed to be about half that of open arcs, a third of the inclosed arc figure, and a sixth of the common incandescent service. While the first cost is high, yet it may under many conditions be lower than the installation cost per candle power for incandescent service. This item of installation cost has varied from one-half to twice that of the other forms of electric lighting. However, the makers claim to be able in almost every case to guarantee that the reduced operating cost will be such as to pay the entire cost of installation on equipments of considerable size.

The life of the tubes is guaranteed for 2,000 hours, and averages much above that, perhaps about 5,000 hours. Individual cases have run to 7,500 hours. The general appearance of the alternating and direct current lamps is given in Figs. 13 and 14.

The Moore Vacuum Tube.—Mr. D. McFarlane Moore began his work on commercializing Geissler tubes about 12 years ago. In the various stages of development the system has had different lengths, sizes and shapes of vacuum tubes and numerous devices for the production of the necessary high potential to make the tubes luminous. As these have been noted in various scientific journals and papers and as they are not in use, mention will be made only of the form actually being installed for practical lighting.

In its present form the vacuum tube consists of a 1¾-inch glass tube of any desired length, supported near the ceiling by suitable brackets and encircling the area to be illuminated. This continuous tube is made in place from 6 or 8-foot lengths, joined with blowpipes by methods made familiar by makers of physical apparatus. The ends of this long tube are brought to a steel box about 2 feet square. Large

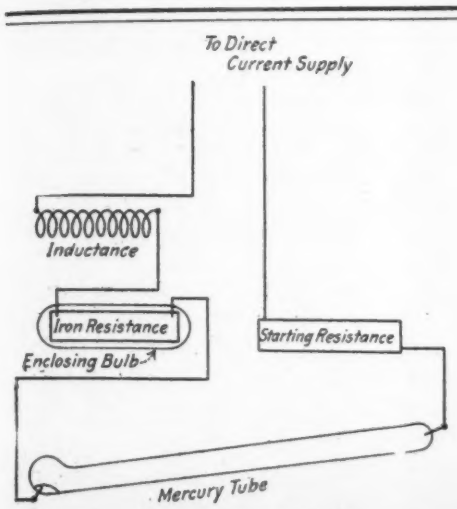


Fig. 11.—For Direct Current Lamps.

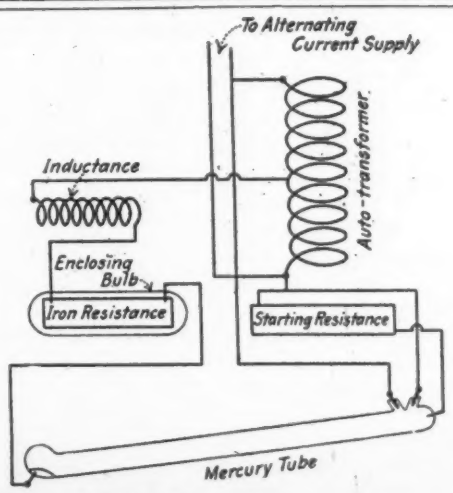


Fig. 12.—For Alternating Current Lamps.

Diagrams Showing Arrangement of Parts of Mercury Vapor Lamps

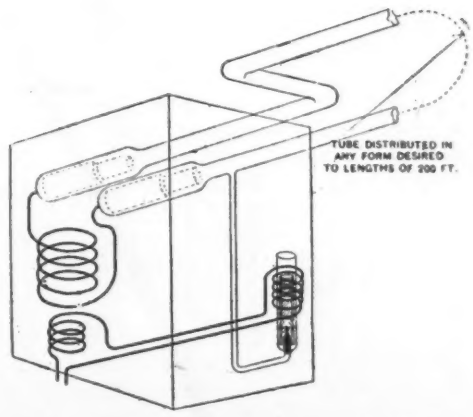


Fig. 15.—Diagram Showing Arrangement of Essential Parts of "Moore Light."

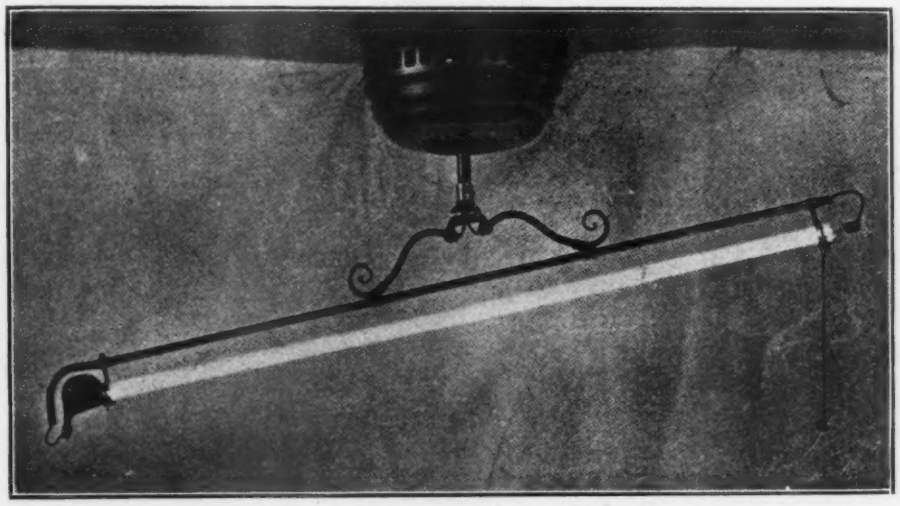


Fig. 13.—Direct Current Form.

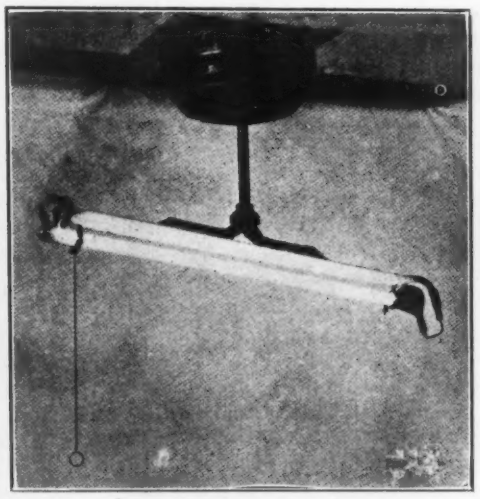


Fig. 14.—Alternating Current Form.

The Cooper Hewitt Mercury Arc Lamps.

carbon electrodes are inside each end of the tube, connected to the outside contacts by platinum sealed in the glass. The completed tube is exhausted in position by a portable mechanical vacuum pump to a pressure claimed to be about 1–40,000 of an atmosphere.

The necessary high tension current is obtained from a simple transformer, located in the steel box mentioned above.

It was early shown that, with such tubes, the rarefaction steadily increased, increasing the resistance in an obscure manner until it became too high for the working voltage. Consequently the light of the tube soon went out. This difficulty is at present overcome by a most ingenious regulating valve. A piece of $\frac{7}{8}$-inch glass tubing is supported vertically, with its bottom contracted into a $\frac{3}{8}$-inch glass tube, which extends to the main lighting tube. At the point of contraction a $\frac{1}{4}$-inch carbon plug is cemented in. Its porosity is such as to allow gases easily to percolate through, but not sufficient to allow the mercury which normally completely covers it to pass. Partly immersed in the mercury and concentric with the carbon plug is a smaller movable glass tube, whose upper part carries a bundle of soft iron wires, which form the core of a solenoid in series with the primary of the transformer. All these parts are shown in the diagram, Fig. 15. There is a critical point of vacuum at which the conductivity is a maximum, and the tube normally works a little below this. As the vacuum becomes higher the conductivity increases and a greater current flows through the solenoid. This lifts the displacer, lowers the mercury level and exposes the carbon tip. Immediately a minute amount of gas passes into the vacuum tube, until the vacuum falls to normal and equilibrium is established again. This action is repeated about once a minute during the use of the tube. This feature of the Moore apparatus is also shown in Fig. 15.

When the regulating valve is arranged to admit air, the light given by the tube is rose colored. If nitrogen is used the light is yellow, and when carbon dioxide is admitted a close imitation of daylight color values is obtained. It should be stated that the tube giving "white" light is not as efficient in light production as when air is admitted.

Tests by the New York Electrical Testing Laboratories have shown an efficiency of 0.65 watt per candle power for the rose colored tubes; with those for the production of white light the efficiency is about 1.5 watts per candle power.

The advantages of the light may be briefly presented: A low intrinsic brilliancy of about 12-candle power per lineal foot of tube; a better efficiency than carbon filament lamps; a good diffusion, but not entire elimination of shadows. Its disadvantages lie in present difficulties of repair, high initial cost and lack of flexibility. A typical installation is shown in Fig. 16, which shows the lobby of the Madison Square Theater.

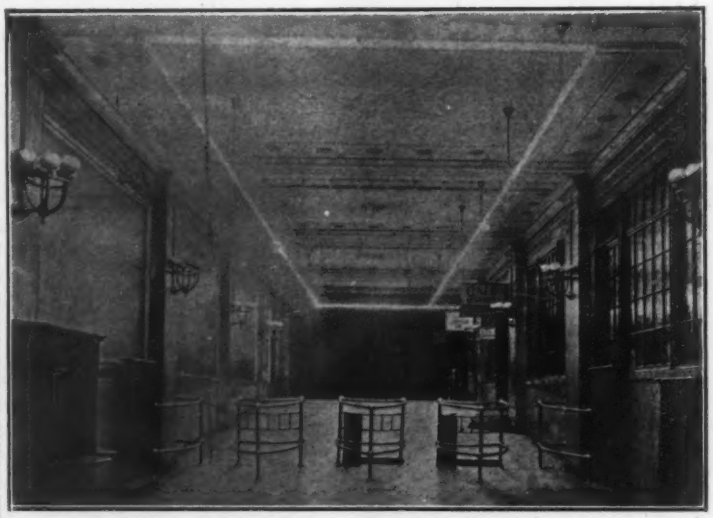


Fig. 16.—Typical Installation of Moore Vacuum Tube, Lobby of Madison Square Theater, New York City.

Wasteful Water Heating Burners.

Mr. W. H. Y. Weber, in a series of notes on town gas regarded as fuel, now running in the *Gas World*, has this to say respecting the matter named in the heading:

The efficiency of some of these appliances is high. This is especially true of the best warm water circulators and geysers; which give as much as 90 to 93 per cent. of the calorific value of the gas burned to the water passing through them. Small kettles boiled over ordinary gas ring burners only have a maximum efficiency of from 40 to 50 per cent. Hundreds of thousands of household kettles and cooking pots are boiled over gas every day, the consumption for this necessary purpose accounting for the larger portion of the total quantity of gas sold for heating; which in London probably amounts to upwards of 60 per cent. of the whole. It is safe to say that much of this gas is burned wastefully. Actually, from the author's experiments, a quart of water can be boiled in a common tin kettle over a cheap burner for a consumption of 1.4 cubic feet of gas, costing from 0.05d. downwards. Rarely, however, in practice is even this degree of economy realized; never, one may confidently assert, as a regular thing. The reason is that too large burners are used under small vessels, the gas, which ought to burn wholly underneath the pot, flaring up all round it. This waste is also attended by an offensive smell of partly burned gas. And, frequently, of course, the gas is kept alight longer than is necessary.

A considerably higher efficiency might be obtained by the employment, for boiling water, of Bunsen burners with more intensified combustion than those in common use. The ordinary laboratory or kitchen bunsen or atmospheric burner usually exhibits a lambent lilac or blue flame; which is hollow. When more air is taken into the mixing tube before ignition, the flame commonly hisses, shows a green inner cone, and is reduced in size. As heating burners are ordinarily made, it is impossible to increase the proportion of primary air beyond this stage; because a tendency to light back supervenes. The proportion of primary air to gas is then about 3½ to 1; complete combustion requiring about 5½ of air to 1 of gas, the balance being obtained from the air surrounding the flame. It is easily possible, however, with improved bunsens of the Kern, Sugg, Bray or Mecker type, to increase the primary aeration of the gas to very nearly the explosion point of 5½ to 1 aforesaid. This results in a solid, intense flame of the smallest possible dimensions and highest temperature; which, by reason of the higher rate of exchange of heat into the water in the pot, and the closer applicability of the flame to its work, will effect an economy of 30 per cent. over the blue, hollow flames usually employed.

The same observation applies to another very extensive and important use of gas—namely, for warming rooms. The simplest way of heating interiors by gas is, of course, by the naked flame burning freely in the air. Every cubic foot of gas so burned liberates 530 B. T. U.'s of heat; and inasmuch as in this climate about 15° F. of elevation of temperature (from 40° to 55° F.) is all that is usually requisite in winter, a cubic foot of gas would warm to this extent about 1,850 cubic feet of air, neglecting loss. So that, assuming the case of a room of this capacity, and the air changing in it by natural ventilation once an hour, a plain gas burner consuming at the rate of 2 cubic feet per hour would suffice to maintain the air at this elevation of temperature; if there were no loss of heat. Such loss, of course, there would be, of considerable and uncertain amount; so that the only purpose of this statement of hypothetical house warming by gas is to show the theoretical capability of gas for the purpose; which is far from being realized. According to the Coal Smoke Abatement Society's tests, 1906, in rooms of a capacity of 4,000 cubic feet, it took from 1.30 to 4.06 cubic feet of gas per hour to raise the temperature of the air of the rooms 1° F. The rooms were far too large for the form of the heating apparatus; which might almost as well have been in the open air. A good deal of effective warming of large volumes of air, as in open shops and open roofed churches, to a degree sufficient to prevent the chilly down-draught experienced in such buildings during cold weather, can, however, be done incidentally by ordinary gas lighting burners.

The only real drawback to this method of warming interiors when carried to a pitch of "comfortable feeling" is the condensation of the water produced by combustion upon the cold walls, the windows, and any metallic surfaces in the room; which is in some circumstances troublesome. For this reason, chiefly, it is preferable only to burn gas openly in a room with the object of warming the air to the point vaguely but clearly recognized as that of "taking the raw feeling off." This is sufficient where people are busily moving about, or sitting with their outdoor clothing on.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

SURELY some of the people want much for nothing. For instance, the selling rate in Macon, Ga., for gas there is $1.25 per 1,000 cubic feet, and anthracite coal is worth $6 to $7 per short ton. At the respective prices one can readily estimate which is the cheaper for use in the kitchen, especially when the climate is considered; but some of the residents now are urging that the Railroad Commission should order a reduction.

THE Cruse-Kemper Company, of Philadelphia, agree that the new holder for the Westfield (Mass.) district will be completed by December 10th.

MR. J. A. PATTEN, formerly Superintendent of the Manitowoc (Wis.) Gas Company, has been appointed Manager of the Holland City (Mich.) Gas Company.

"M. G.," writing to us from Washington Court House, O., under date of the 13th inst., informs us of the death of Judge Horatio B. Maynard, President of the Washington Gas and Electric Company, of Washington Court House, at the home of his daughter (Mrs. H. B. Dahl), the morning of the 11th inst. Deceased was in his 81st year, and his connection with the Company dates back to 1874. He was a native of Massachusetts, but went to Ohio when quite young, and became identified with the law; in fact, he was for years a prominent member of the Ohio bar, and was really considered one of the ablest jurists of Ohio. At one time he was in a law partnership with the Hon. H. M. Daugherty, who was a prominent figure in Ohio national politics. Mr. Maynard served during the Civil War, and retired from the active ranks as Colonel of the 114th Ohio Volunteer Infantry. His son (Mr. Herbert B. Maynard) is Secretary of the Citizens Gas and Electric Company, of Waterloo, Ia.

THE residents of Branford and Short Beach, Conn., are well pleased over the gas service recently laid on to those points by the New Haven (Conn.) Gas Light Company. This statement applies especially to those who have commenced to use gas in the kitchen.

THE Board of Gas and Electric Light Commissioners has under advisement the appeal from the decision of the Board of Aldermen, of Chelsea, Mass., refusing to grant permission to the Company to hook up its mains between the main manufacturing plant and the generating station at East Boston.

A CORRESPONDENT in Cincinnati forwards the following under date of the 14th inst.: "School was held in the building of the Union Gas and Electric Company, of this city, last Wednesday evening with an attendance of over 400. The pupils were the plumbers, gasfitters and dealers in gas appliances of Cincinnati and suburbs. The instructors were the natural gas experts of the Gas Company and experts brought to Cincinnati from the gas fields of Ohio and West Virginia to address the meeting. Natural gas and the appliances needed in its use were the subjects discussed. After months of investigation, the Company's experts finally decided upon the most economical and efficient appliances for the use of natural gas in Cincinnati. When this was determined the meeting of the gasfitters and dealers was called. Very few of those who attended the meeting had had any experience with natural gas and the speakers were besieged with questions. The entire subject was carefully explained in detail. Mr. John Franklin, Superintendent of Distribution of the Company, told of the extension of the main feed lines from the gas fields and explained the belt line system which has been established around the city and suburbs to insure perfect pressure and supply. He also explained the placing and distribution of governors and controlling stations and said that, with the systems devised, there was not the slightest danger of any fluctuations in the gas pressure and that the use of natural gas would be attended with the same degree of safety as artificial gas. Messrs. Morris and Howe, experts in natural gas, explained natural gas heaters and burners, telling just how the most efficient and economical use of natural gas may be obtained. Mr. T. C. Bradshaw of the Gas Company spoke on lighting effects in the use of natural gas mantles. When 'School let out' the 400 pupils were taken to the Havlin Hotel, where they were the guests of President Kenan at a buffet luncheon and smoke. Superintendent Franklin delivered an interesting address to the members of the Gasfitters' Union at the Builders' Exchange on Thursday night, and this is only one of several meetings planned in the Gas Company's campaign of education in the use of natural gas."

ADVICES from Buffalo, N. Y., under date of the 12th inst., go to show that, dissatisfied with the superseded Commissioner of Water, Gas and Electricity, as to the latter's treatment of the Buffalo adjudication in the matter of gas rates there, the Buffalo Gas Company is anxious for a rehearing of the entire matter before the Public Utilities Commission. Attorney Louis L. Babcock, who represented the Gas Company in the long contest for cheaper gas instituted by Mayor Adam, has requested that the city authorities consent to a reopening of the case before the Commission which has taken the place of the State Board which existed before July 1st. Corporation Counsel Desbecker has the quest under advisement. He will look into the legal questions involved and will determine whether it is possible to follow Mr. Babcock's suggestion. Mayor Adam, who opened the crusade for cheaper gas, is considering the matter and he is said to have referred Mr. Babcock to Mr. Desbecker. In the proceedings the city won a victory in that the Commission ordered a reduction in the price of gas to consumers, fixing the price at 95 cents. The decision was handed down the day before the Commission expired legally, but it was dated two days previous to that. In the complaint three specific questions were asked. The price of gas to consumers was to be fixed, the amount the Company could charge as penalties for non-payment was to be regulated, and the rate the Company could sell to the city was to be determined. The Commission dodged everything but one question. It made the gas rate 95 cents flat without commenting on the questions of excess and the charge to the city. The Company is abiding by the 95-cent decision now and several conferences have been held with a view to untangling the penalty charge. These have progressed slowly and now Mr. Babcock comes forward with the proposition to go before the Public Utilities Commission with the question. It is understood that the Company wants the penalty question fixed legally, and to the satisfaction of the city authorities. The Company is also worried about the rate to be charged to the city. Heretofore the Company has been selling to the city under a law which compels a reduction each year. This has been observed by the deduction of a very small fraction each year. In the event of the question not going back to the Utilities Commission this point may prove a knotty problem if the Company attempted to sell at the Commission's rate to the city.

THE contention over the proposition to sell a plot of land, owned by the city of Reading, Pa., to the Consumers Gas Company, of that city, has been settled by the authorities consenting to a lease of the plot to the Company for a term of 25 years. The Company proposes to make important works' extensions, through its lessor, the United Gas Improvement Company.

"R. R. S.," writing from Akron, O., under date of the 13th inst., incloses the following: "Mr. H. C. Hill, local Manager of the Mohican Oil and Gas Company, lessees of the Akron Gas Company, after holding a position with the Akron and Mohican Gas Companies for over 5 years, will leave Akron Monday to assume the duties of Manager of the Laporte (Ind.) Gas Light Company. The week prior to his resignation the employees of the Akron Gas Light Company's office force presented him with a handsome initial seal ring, and the presentation was accompanied by an expression of goodwill, and good wishes for his future that certainly will be remembered by the recipient for many a day."

THE Southwest Improvement Club, which has often been prominent in the living matters of Omaha, Neb., at a special meeting held some evenings ago, put itself squarely on record in opposition to a bond issue for the construction and operation of a gas works on public account.

THE first quarterly dividend (at the rate of 6 per cent. per annum) on the preferred stock of the Chattanooga (Tenn.) Gas Company, is payable the 1st prox.

MR. J. F. TIBBET and associates, of Riverside, Cal., have petitioned the authorities of Newport Beach, Cal., for a franchise under which to construct and operate a gas plant.

THE authorities of El Paso, Tex., have decreed that the El Paso Gas and Electric Company shall equip all gas connections to buildings with a stopcock in box located close to the curb line, the Company to "maintain the same in good condition."

MR. S. V. DAVIDSON seems to be the main party in interest in the proposed gas plant for St. John, Ore. A site has been purchased for the works at Richmond and Bradford streets, and he declares that construction work will be underway within 30 days.

THE arguments advanced by Mr. George McLean, on behalf of a plea to the authorities for an extension of the franchise of the Key City Gas Company, of Dubuque, Ia., seem to have been of the persuasive and cogent type, for the Council has agreed to continue the agreement for a further period of 10 years; or until December 31, 1932. Mr. McLean and his associates will now go on with the scheme planned some time back for important additions to the manufacturing and distributing systems.

AT the annual meeting of the Granville (N. Y.) Electric and Gas Company the officers elected were: Directors, B. G. Higley, George Tait, E. T. Brackett, T. D. Howland, E. R. Norton, F. T. Pember, H. J. Stevens, F. C. Sheldon and F. S. Fogg; President, B. G. Higley; Vice-Presidents, F. T. Pember and George Tait; Treasurer, H. J. Stevens; General Manager, F. S. Fogg; Superintendent, Charles Schermerhorn.

"L. M. V.," writing from Galesburg, Ills., says that the Galesburg City Council has approved a recommendation from its special committee having the matter in charge, that the proceedings in respect of the validity of the charter of the Galesburg Gas Company be dismissed without prejudice, providing the Company will enter into a contract with the city to furnish gas of 20-candle power at a flat rate of $1 per 1,000 cubic feet, will agree to an ordinance providing for the testing of meters and due inspection of gas as to quality, and to pay the costs of the litigation. This latter has been going on for almost a year. As the conditions are onerous, and as the Company's position, especially in respect of the proposed gas rate, seems fully fortified by facts that look easily able of being set forth before a proper tribunal, it is not likely the litigation will be speedily brought to a close. Why not have the whole thing threshed out before a specially appointed board of arbiters?

SOME time ago the Commissioners of the District of Columbia were importuned by the Northwestern Suburban Citizens Association to order the Washington Gas Light Company to make certain main extensions, particularly through Rhode Island avenue. The Association had asked the Company to make the extensions, and a refusal was returned on the ground that an examination of the routes mapped seemed to prove that the probable gas sales along the lines would not return anything like an adequate interest on the investment. The Commissioner then looked up the nature of their authority over such extensions and returned the answer to the Association that the applying laws did not permit them to order compulsory main additions.

WORK on the plant for the supplying of artificial gas to the residents of Auburn, Ind., is underway. The natural gas service there is virtually at an end.

MR. JAMES T. LYNN and associates have informed the Ordinance Committee of the Port Huron (Mich.) City Council that they will under no consideration accept a franchise which provides that the selling rate in Port Huron shall not exceed 75 cents per 1,000 cubic feet. It is likely that the matter of a fair selling rate will eventually be left to a commission, which would seem the fair thing to do, provided some one on the commission was conversant with the practical side of gas manufacture and distribution. No one practically in the gas industry, either from a manufacturing or investing standpoint, could consider 75 cents a fair rate for Port Huron. Furthermore, the residents and authorities of the Port should have faint trouble in recalling the conditions that governed the gas business there just prior to the advent of Mr. Lynn and his partners.

THE new plant of the City Light and Power Company, of Beatrice, Neb., will be constructed under the supervision of Mr. H. V. Riesen.

ALTON D. ADAMS, "a gas engineering expert of Worcester, Mass.," for such is the titling given to him by the Omaha (Neb.) *News*, has written to Mayor Dahlman, of Omaha, that $3,500,000 is too much to spend on a municipal gas plant. In fact, the "expert" goes further in the premises by declaring that a plant having the capacity necessary for Omaha could be built for "something over" $1,000,000. Beyond a doubt; yes, for "something over" that sum.

AT the annual meeting of the shareholders in the Worcester (Mass.) Gas Light Company the officers elected were: Directors, Charles D. Lamson, A. G. Bullock, F. H. Dewey, Albert Wood, S. B. Woodward and T. B. Eaton; President, Charles D. Lamson; Treasurer and Clerk, J. B. Hamilton.

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MONDAY, SEPTEMBER 23, 1907.

The Market for Gas Securities.

The city gas share market dawdles along after the fashion of the general share list, for which, of course, there is no good reason. Consolidated opened to-day (Friday) at 105 to 107, this being ex-dividend, which was payable last week. It is thought by men well informed as to the local situation that there will be a quick advance in values in gas shares, the thought being based on common sense dealings between the Public Service Commission and the New York and Brooklyn Companies.

Brooklyn Union is very sluggish, in fact positively weak, 95 being bid for it, holders standing out for 110. About 105 is the likely selling point, and at that it looks remarkably cheap, even with gas at 80 cents per 1,000. Peoples, of Chicago, is trying to get to 90, and the chances are it soon will. A fair price for it, as to value, would be 110. Massachusetts Gas Companies shares still remain at ridiculously low figures.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.
16 WALL STREET, NEW YORK CITY.
SEPTEMBER 23.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	105	107
Central Union Gas Co.—				
1st 5's, due 1972, J & J	3,000,000	1,000	92	97
Equitable Gas Light Co.—				
Con. 5's, due 1931, M. & S.	1,000,000	1,000	..	105
Mutual	3,500,000	100	150	180
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	80	90
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p.ct.	1,000,000	..	98	104
Northern Union—				
1st 5's, due 1927, J. & J	1,250,000	1,000	101	103
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	100	105
Con. 5's, due 1945, J. & J.	1,500,000	..	97	101
Standard	5,000,000	100	70	100
Preferred	5,000,000	100	100	125
1st Mtg. 5's, due 1930, M. & N	1,500,000	1,000	100	105
The Brooklyn Union	15,000,000	1,000	95	110
1st Con. 5's, due 1948, M. & N	15,000,000	..	..	102
Yonkers	299,650	500	130	..
Out-o'-Town Companies.				
Bay State	50,000,000	50	¼	⅜
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	..	65
" 1st Mtg. 5's	509,000	1,000	95	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
" " Bonds, 5's	5,250,000	1,000	63	66
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	106½
Cincinnati Gas and Electric Co.	29,500,000	100	94½	95
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	92	98
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	87	88
Preferred	3,026,500	100	107½	109
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	..	90
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	..	..	100
Detroit City Gas Co	5,000,000	50	..	50
" Prior Lien 5's	4,618,000	1,000	..	98
Detroit Gas Co., 5's	851,000	1,000	75	80
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	103	105
Bonds, 5's	10,500,000	..	101	102½
Indianapolis	2,000,000	..	60	70
" Bonds, 5's	2,650,000	..	104½	105
Jackson Gas Co	350,000	50	82	..
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	86
Bonds, 1st 5's	3,823,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	..	105
Preferred	2,500,000	100	95	110
Bonds	10,000,000	1,000	104	104½
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	108	108½
" 6 per cent. scrip, due 1910	100,000	25	60	60½
Massachusetts Gas Companies of Boston	25,000,000	100	51	51½
Preferred	25,000,000	100	80½	81
Montreal, Canada	2,000,000	100	218	218½
Nashville Gas Lt. Co	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	6,000,000	..	137	138
New Haven	2,000,000	25	200	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	86	87¼
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	30,100,000	1,000	..	..
" 2d "	2,500,000	1,000	104	..
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	104½	105¼
San Francisco, Cal	15,800,000	00	..	..
St. Joseph Gas Co. 1st Mtg. 5's	751,000	1,000	92	..
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DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO., N. W. CORNER BROAD AND ARCH STS., PHILADELPHIA, PA., Sept. 11, 1907.

The Directors have this day declared a quarterly dividend of 2 per cent. (one dollar per share), payable Oct. 15th, 1907, to stockholders of record at the close of business, Sept. 30, 1907. Checks will be mailed.

1684-5 LEWIS LILLIE, Treasurer.

Estimates furnished for the erection of complete gas works or the extension and modernizing of old works. All work warranted. Both water gas and coal gas.

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Young man, at present situated in the South, wants a position in the North. Knows thoroughly the operating of gas, water and street railway corporations, and the office work connected therewith as well. Location in Pennsylvania or New Jersey preferred.

1685-2 Address, "L. R. T.," care this Journal.

Position Wanted

By young, married gas man, with 14 years' practical experience in the manufacturing of water and coal gas and distribution of same. Address, "G.,"

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WANTED,

A FOREMAN THOROUGHLY POSTED IN COAL GAS MANUFACTURE,

For growing city of 15.0 0 population, in the Central West. State experience and wages desired.

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GAS BOOKS WANTED.

My library of gas books and subjects akin thereto, and which I believe was the most complete in existence, was destroyed in the April 18, 1906, San Francisco disaster. In re-establishing this library, which will find an ultimate home with a gas association or educational institution, I am desirous of securing all available gas literature printed in the English language, including technical works, reports, pamphlets, etc., and will purchase such as I do not yet possess. Those having such works will accommodate me by sending a description thereof, stating condition of volume and net price desired, carriage included. L. P. LOWE,
1681-2m 1214 Polk St., San Francisco, Cal., U. S. A.

Patents for Sale.—English Patent No. 3,021, U. S. Patent No. 767,019, Improvements relating to Gas Burners suitable for Lighting by Incandescence. This invention relates to a device for regulating the admission of gas to the flame of incandescence gas burners, and to a device for cutting off or admitting the gas feeding the lighting or main flame in burners provided with a pilot flame.

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An A-1 gas plant in a growing Southern town of 10,000 people is for sale. Plant just erected and operating about 9 months. Excellent outlook. Plant is ample for several years to come. Will sell reasonable. Only cause for selling is that the owners do not have the time to spend on it that they should.

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Do You Wish to Know

what size of pipe to use to convey any quantity of gas, any distance, with any loss of pressure and any initial or final pressure? Then use

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GAS AND ELECTRIC PROPERTIES BOUGHT AND SOLD.

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We have an Attractive Pennsylvania Property for Sale.

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Utilize Your Gas Liquor.
NO EXTRA LABOR OR OPERATING EXPENSES.
IMPROVED AMMONIA CONCENTRATOR.
About 100 in use. Write to
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STAMFORD ODORLESS HEATERS,
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MADE IN A NUMBER OF STYLES AND SIZES.
WRITE TO-DAY FOR OUR NEW HEATER CATALOG.
THE STAMFORD GAS STOVE CO.,
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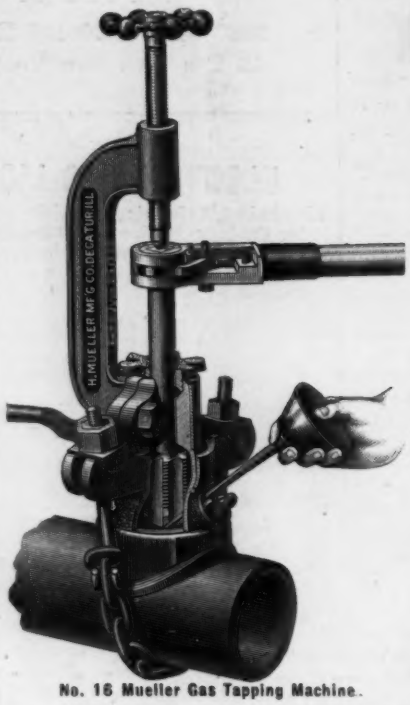

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Is medium priced, but is the strongest, most durable and easiest to operate of any machine of its class on the market. It taps dry or open mains or mains under pressure from ⅝ to 2-inch and possesses

A PRONOUNCED ADVANTAGE

In the swiveled goose neck, which admits of the operator turning it to any desired position.

The same care is exercised in its manufacture as given the higher class machines of Mueller make, and it is subjected to an actual working test to prove its fitness before leaving the factory.

In every essential detail it is superior to many machines for which you are asked more money. Unconditionally Guaranteed.

Write for prices and literature.

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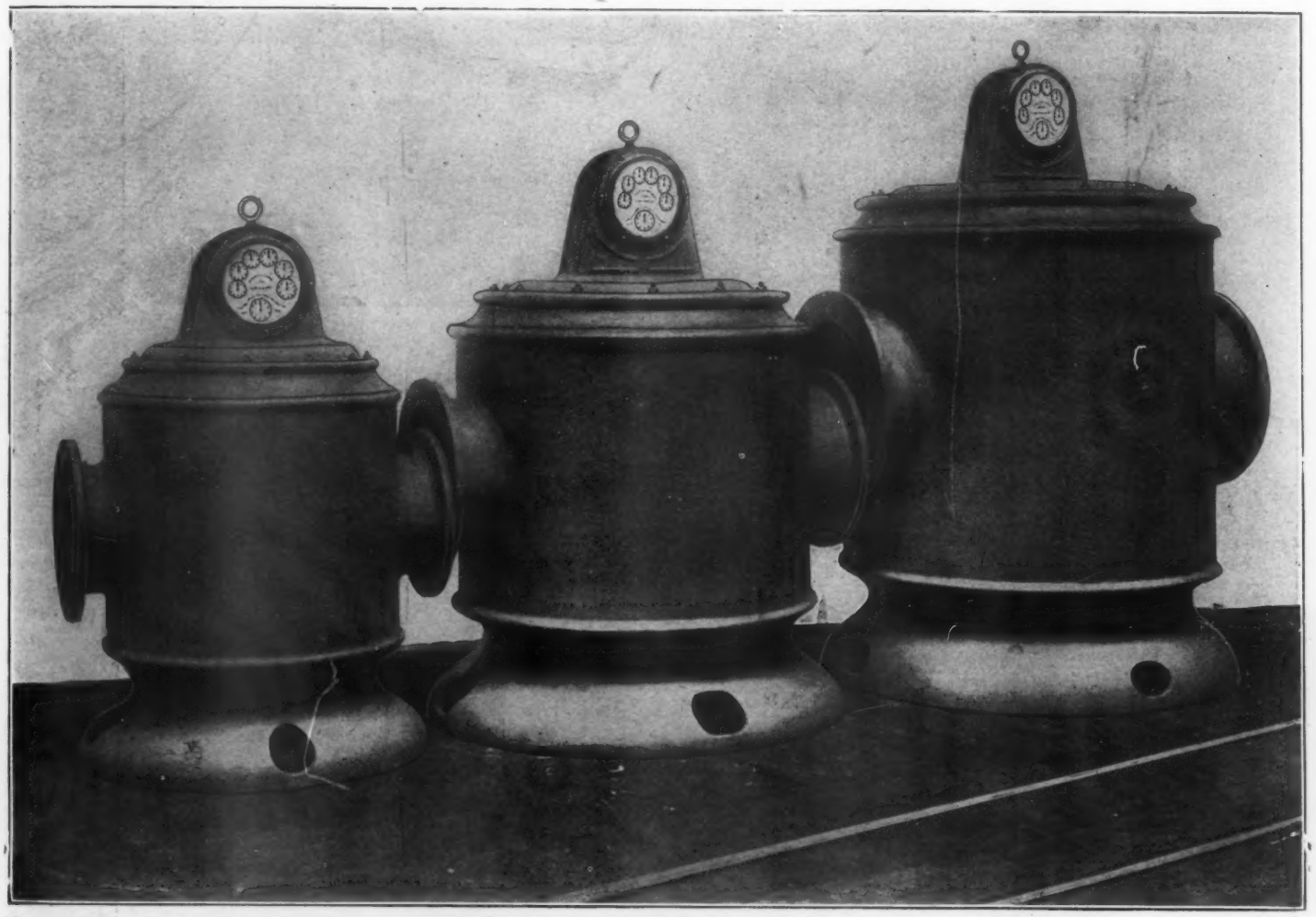
MEASURING A DAILY MAKE OF MORE THAN 300,000,000 CUBIC FEET.

400 Installations to date with capacities from 500,000 Cubic Feet per Hour down to 5,000 Cubic Feet per Hour.



30,000 cu. ft. per hour.
12-inch connections.
40-inch face to face flanges.
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FOR NORWICH, N. Y.

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16-inch connections.
52-inch face to face flanges.
61 inches floor to c. of dial.

FOR EL PASO, TEXAS.

60,000 cu. ft. per hour.
20-inch connections.
58-inch face to face flanges.
70 inches floor to c. of dial.

FOR CHESTER, PA.

The above engraving was reproduced from a photograph taken recently when these three meters were on the floor of our factory ready for shipment. Upwards of 50 Rotary Station Meters have at this date been installed or contracted for by gas companies located in 17 States of this country, and several in Canada.

ROTARY METER COMPANY TRADE MARK

One-half the cost—One-tenth the space of old style wet meters.

When in need of Station Meters, write

ROTARY METER COMPANY,

280 Broadway, NEW YORK.

Send for Catalog.

P. PLANTINGA, President W. E. STEINWEDELL, Secretary

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Main Office and Shops

CLEVELAND, OHIO.

NEW YORK OFFICE, - - 56 PINE STREET.

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TAR EXTRACTORS, WASHERS, PURIFIERS,
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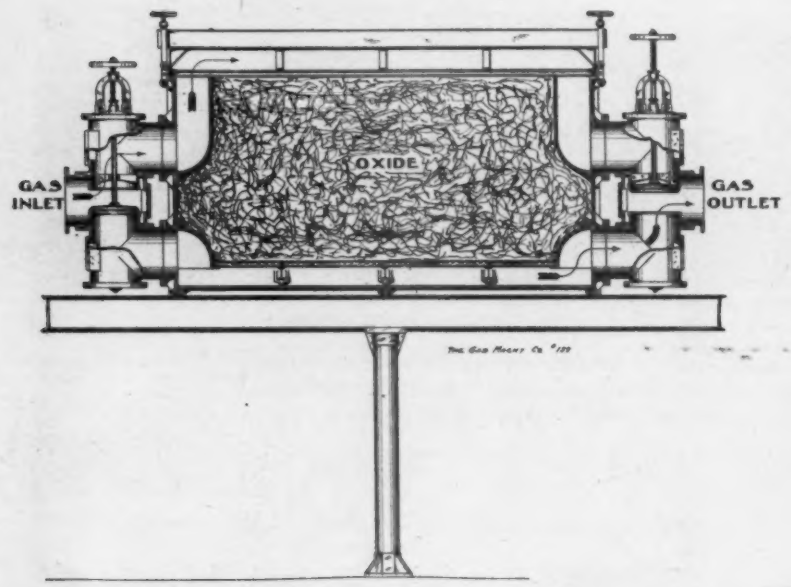

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THE GAS MACHINERY CO.
CLEVELAND, OHIO.

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LACLEDE PLANT:
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ST. LOUIS, MO.

CHRISTY PLANT:
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OUR OWN DESIGNS INCORPORATED IN OUR BENCHES OF HORIZONTAL, INCLINED AND VERTICAL RETORTS.

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BOILER SETTINGS,
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GAS BENCH SETTINGS,
GLASS HOUSE REFRACTORIES,
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CLAY PRODUCTS OF EVERY DESCRIPTION.

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ASK ANY GAS COMPANY WHO USES BRAY BURNERS WHY THEY USE THEM,

And their answers would contain more reasons than would fill this page. Reduced to a few words it would be—

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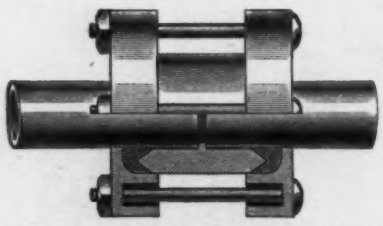
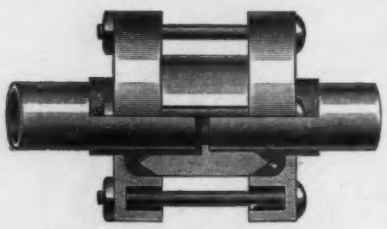
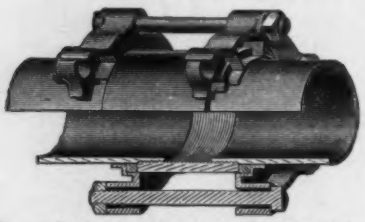
We make Gas Appliances of all kinds. SOLE AGENTS for BRAY BURNERS for the UNITED STATES and CANADA.

Self-Lighting Burner.


Regular Coupling, Style 1, for Plain End Wrought Iron Pipe.


Insulating Coupling, Style 5, for Plain End Wrought Iron Pipe,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Long Sleeve, Style 2, for Mending Broken Lines.

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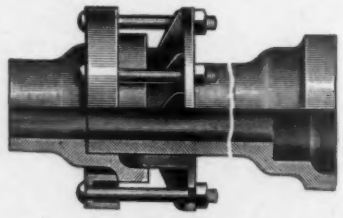
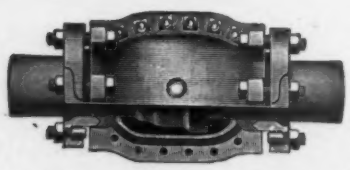
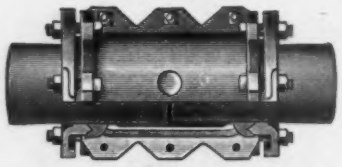
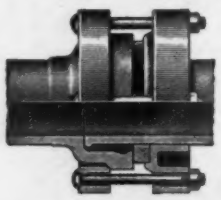
STATE REQUIREMENTS AND SEND FOR CATALOGUE.

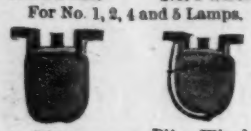

Coupling, Style 9, for Special Style Cast Iron Pipe.


Split Sleeve for Repairing Broken Bell or Cast Iron Pipe.


Split Sleeve for Repairing Broken or Cracked Cast Iron Pipe.


Clamp, Style 4½, for Repairing Leaky Lead or Cement Joints in Cast Iron Pipe.

No. 1 Plain. No. 1 Wired
For No. 1, 2, 4 and 5 Lamps.


Bijou. Bijou Wired.
For No. 3 (Bijou) Lamp.

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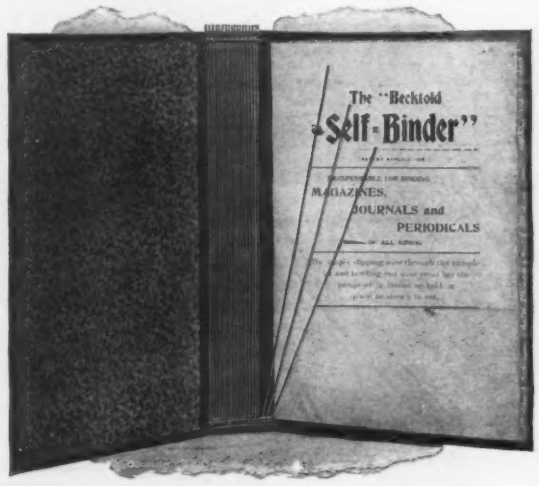

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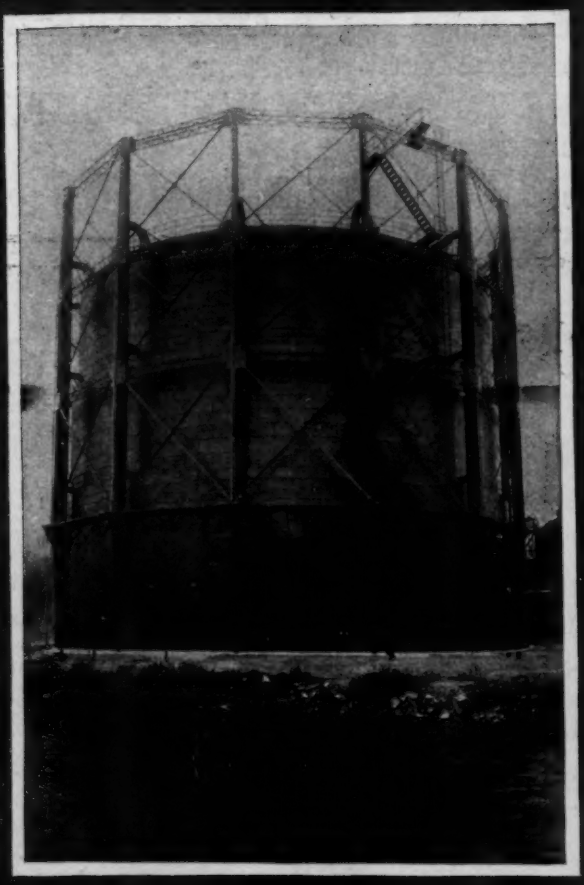

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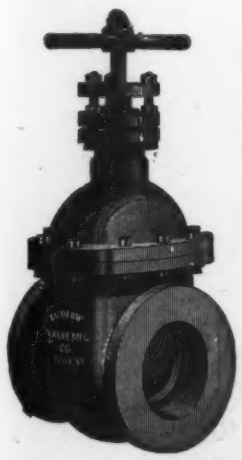

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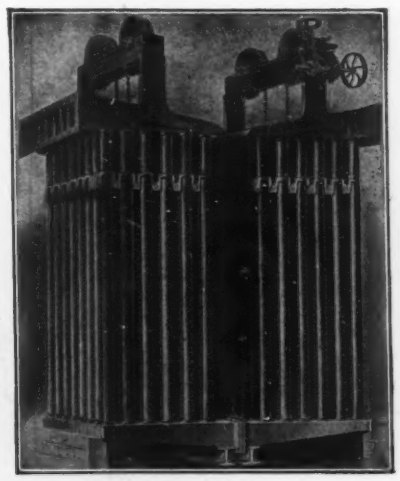

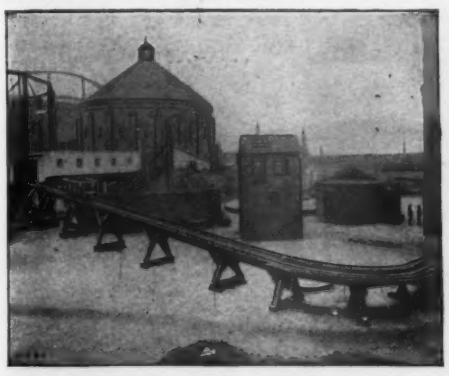

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After the stack-valve gases have passed through the Green Air Heater they may be then passed through a GREEN FUEL ECONOMIZER to heat the boiler feed water, saving as much as 25 per cent. of the boiler fuel. The result is that a Green Air Heater and a Green Fuel Economizer will save from 50 per cent. to 60 per cent. of their first cost annually in a water gas plant. Write for circular "AG" and results of actual tests.

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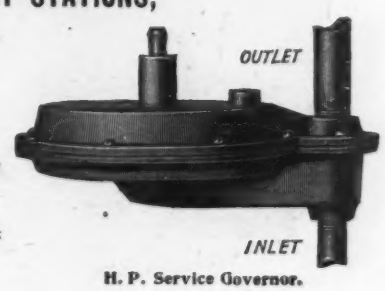

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in the Adrian Gas Company plant were opened after 18 months' continuous use and found to be entirely free from tar and pitch. :: ::

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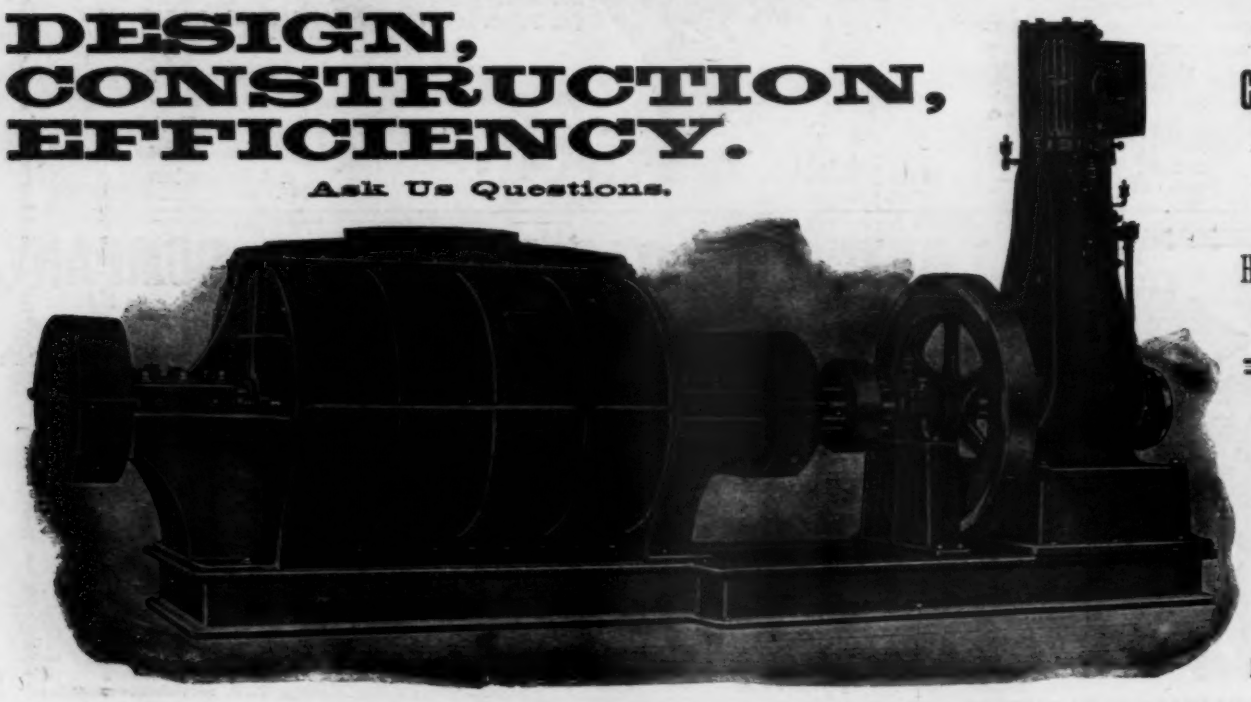

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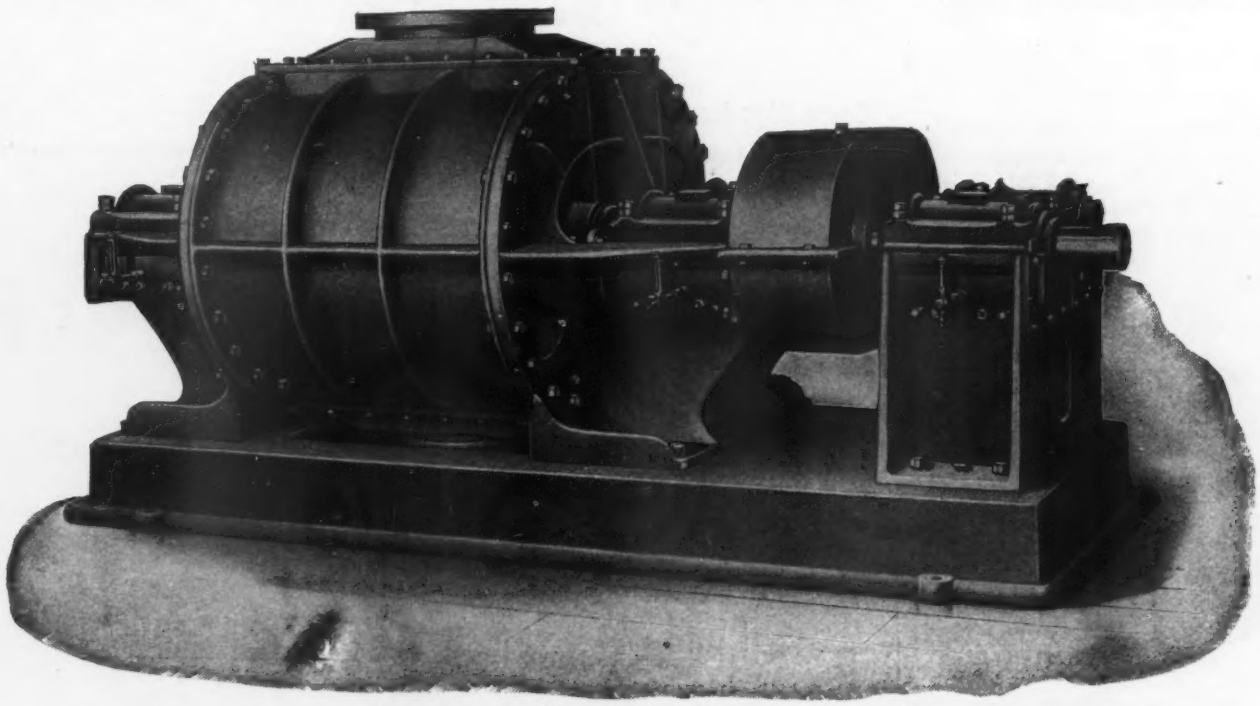

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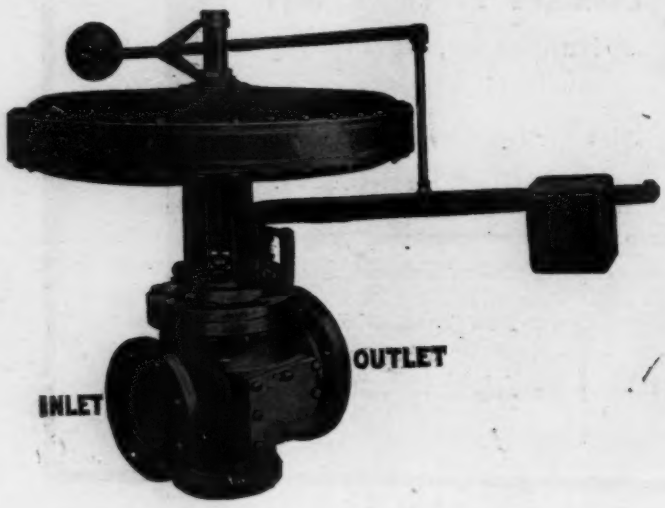

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PUBLIC LIGHTING TABLE.

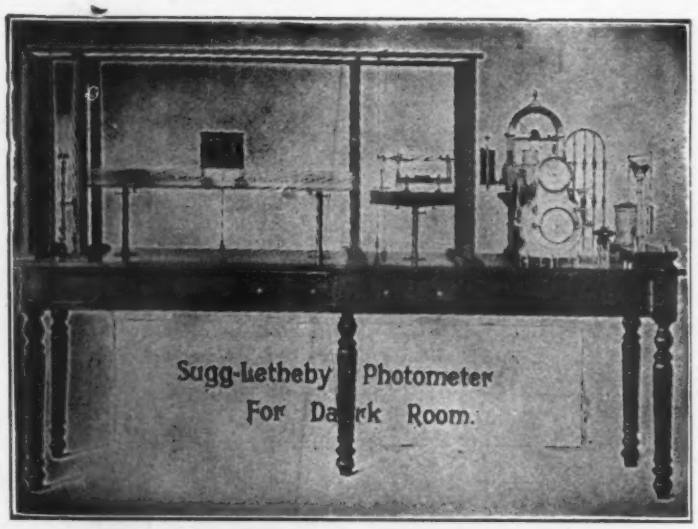
OCTOBER, 1907.

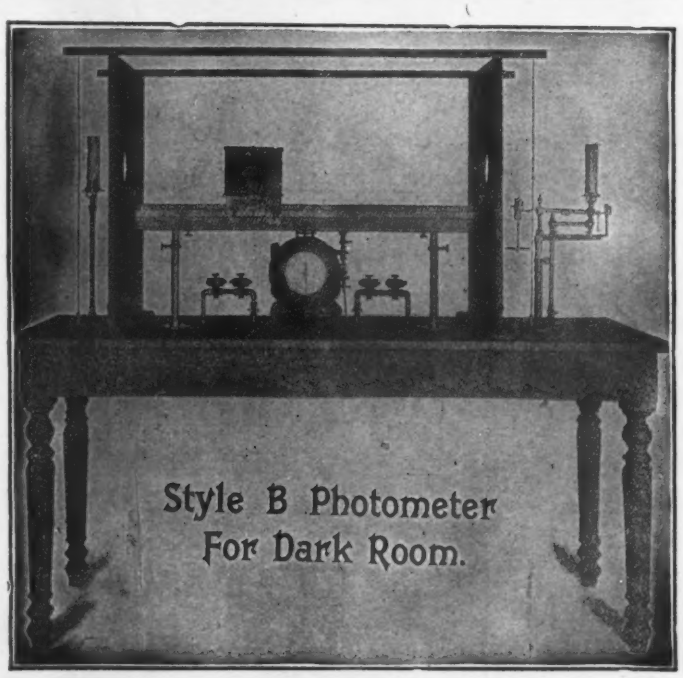
Day of Week.	Table No. 1. Following the Moon. Date.	Light.	Extinguish.
Tue.	1	6.10 PM	1.50 AM
Wed.	2	6.10	2.50
Thu.	3	6.10	5.00
Fri.	4	6.10	5.00
Sat.	5	6.10	5.00
Sun.	6	6.00 NM	5.00
Mon.	7	6.00	5.00
Tue.	8	6.00	5.00
Wed.	9	6.00	5.00
Thu.	10	6.00	5.00
Fri.	11	7.30	5.00
Sat.	12	8.20	5.00
Sun	13	9.20 FQ	5.10
Mon.	14	10.30	5.10
Tue.	15	11.30	5.10
Wed.	16	12.40 AM	5.10
Thu.	17	1.50	5.10
Fri.	18	3.00	5.10
Sat.	19	No L.	No L.
Sun.	20	No L FM	No L.
Mon.	21	No L.	No L.
Tue.	22	5.40 PM	7.20 PM
Wed.	23	5.40	7.50
Thu.	24	5.40	8.30
Fri.	25	5.40	9.10
Sat.	26	5.40	10.00
Sun.	27	5.30	10.50
Mon.	28	5.30 LQ	11.40
Tue.	29	5.30	12.40 AM
Wed.	30	5.30	1.40
Thu.	31	5.30	2.40

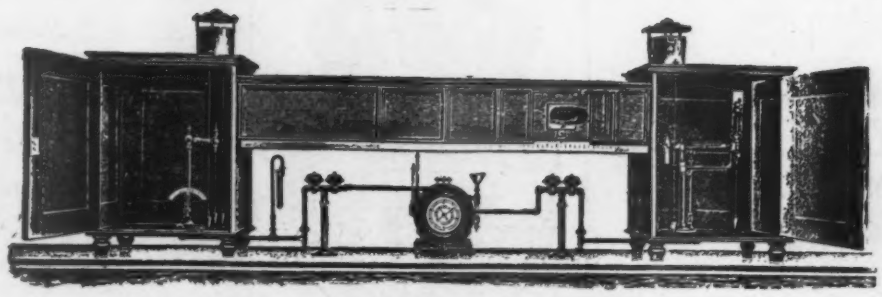
TOTAL HOURS DURING 1907.

By Table No. 1.

	Hrs.Min.
January	211.10
February	193.40
March	182.10
April	167.00
May	157.00
June	145.30
July	151.50
August	162.30
September	175.30
October	202.40
November	209.30
December	231.50
Total, yr.	2190.20







Closed Photometer For Light Room.

CIRCULARS SENT ON REQUEST.

PUBLIC LIGHTING TABLE.

OCTOBER, 1907.

Day of Week.	Table No. 2. New York City. All Night Lighting. Date.	Light.	Extinguish.
		P. M.	A.M.
Tue.	1	5.30	5.00
Wed.	2	5.30	5.00
Thu.	3	5.30	5.00
Fri.	4	5.30	5.00
Sat.	5	5.30	5.00
Sun.	6	5.30	5.00
Mon.	7	5.30	5.00
Tue.	8	5.20	5.10
Wed.	9	5.20	5.10
Thu.	10	5.20	5.10
Fri.	11	5.20	5.10
Sat.	12	5.20	5.10
Sun.	13	5.20	5.10
Mon.	14	5.20	5.10
Tue.	15	5.10	5.20
Wed.	16	5.10	5.20
Thu.	17	5.10	5.20
Fri.	18	5.10	5.20
Sat.	19	5.10	5.20
Sun.	20	5.10	5.20
Mon.	21	5 10	5.20
Tue.	22	5.00	5.30
Wed.	23	5.00	5.30
Thu.	24	5.00	5.30
Fri.	25	5.00	5.30
Sat.	26	5.00	5.30
Sun.	27	5.00	5.30
Mon.	28	5.00	5.30
Tue.	29	4.45	5.35
Wed.	30	4 45	5.35
Thu.	31	4.15	5.35

TOTAL HOURS DURING 1907.

By Table No. 2.

	Hrs.Min.
January	423.20
February	355.25
March	355.35
April	298.50
May	264.50
June	234.25
July	243.45
August	280.25
September	301.15
October	374.30
November	401.40
December	433.45
Total, yr.	3987.45

NEW YORK, 318 West 42d Street.
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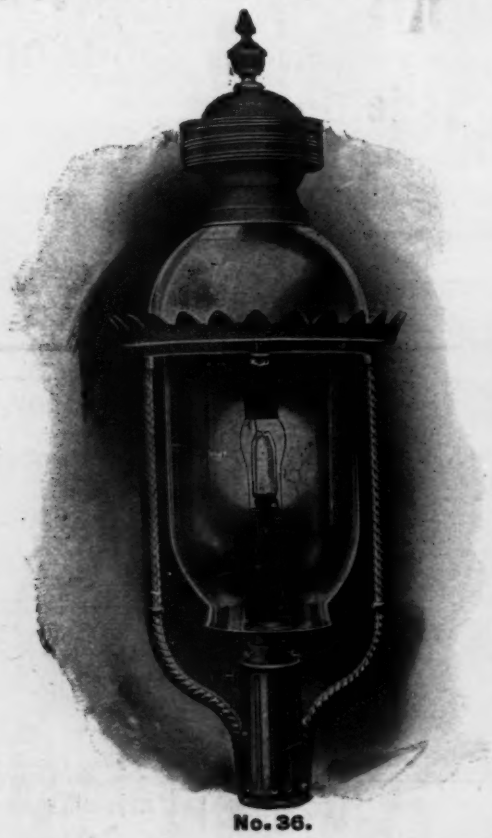
....OF AMERICA....



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Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

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Succeeds and Excels the Electric Light at One-Quarter the Cost.

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Perfect Combustion.
Lowest Gas Consumption.
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Will Not Blacken Mantles.
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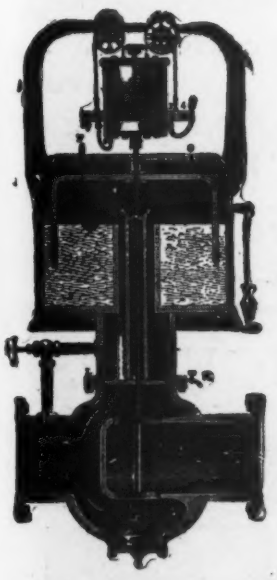

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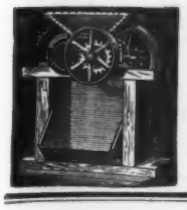

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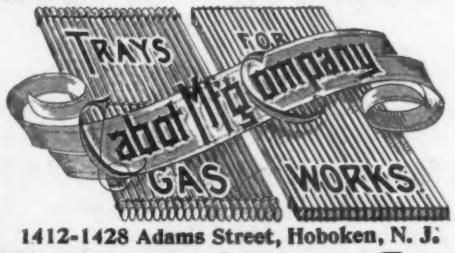

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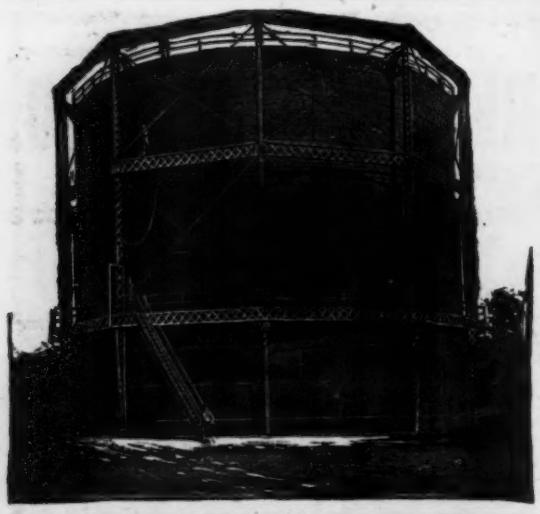

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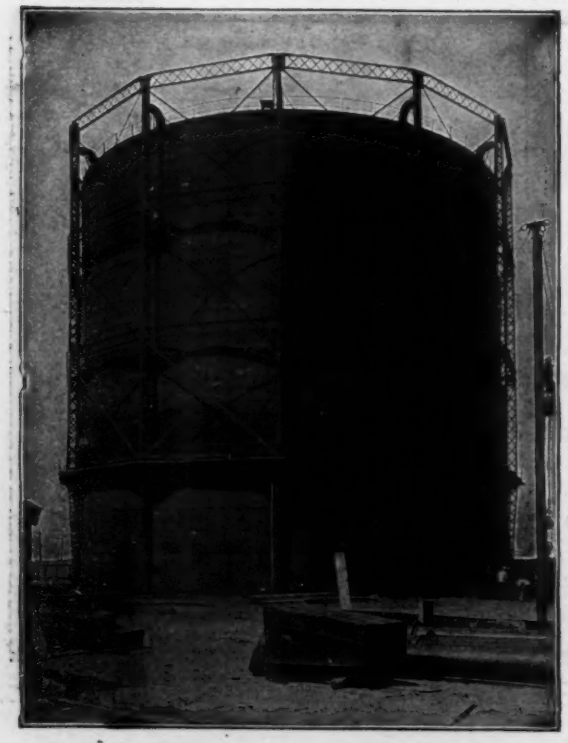

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If you have some ordinary meters to be repaired, send them to us and let us repair and convert them into prepayment meters. They will be a source of satisfaction and profit to you.

SEND FOR OUR CATALOGUE AND OUR PREPAYMENT BOOKLET.